Psychological need satisfaction and academic stress in college students: mediator role of grit and academic self-efficacy

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Abstract
Students, who are trying to complete academic activities in an educational environment, are objected to academic stress. Research results indicated that this stress can be reduced by the individual and psychosocial resources of them. So, this study aimed to determine the mediating role of grit and academic self-efficacy in the relationship between students’ psychological need satisfaction and academic stress. The research was conducted on 967 college students who are studying at education, theology, and medical education faculty. We used serial mediation analysis to determine the mediator effect. Results demonstrated that there are statistically significant positive relationships between autonomy, competence, and relatedness, which are the components of psychological need satisfaction, grit, and academic self-efficacy, and negative relationships between academic stress. Mediation analysis results showed that the serial mediator effect of grit and academic self-efficacy was statistically significant in the relationship between autonomy, competence, relatedness, and academic stress. The research findings were interpreted according to the self-determination theory and positive psychology literature.

Keywords Psychological need satisfaction · Academic stress · Grit · Academic self-efficacy

Introduction

Psychological need satisfaction

As claimed by the self-determination theory, psychological need satisfaction is considered a concept that focuses attention on three basic needs, autonomy, competence, and relatedness, which are necessary for human development and contribute to psychological

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functionality and growth when it is satisfied (Deci & Ryan, 2002). The first component of the psychological need satisfaction, autonomy, includes individuals deciding on their freedom when taking action, knowing that the power is theirs, and the freedom and responsibility of being able to choose without being influenced by others. Another constituent, competence, reflects how an individual perceives their potential when taking any action; in other words, it reflects the state of individuals perceiving themselves as self-sufficient. The third component, relatedness, is viewed as a dimension that deals with the positive social relations that the individual has established with others. The importance of fulfillment of these three main psychological needs is pointed in individuals having an active life, becoming their higher self and ability to deal with the obstacles coming their way, and stress-making stimulants (Deci & Ryan, 2002; Ryan & Deci, 2000).

Studies also prove that psychological need satisfaction has an aspect impacting students’ academic achievements in a positive way (Gutiérrez et al., 2018; Zhou et al., 2021), and increases their academic motivation (Gnambs & Hanfstingl, 2016), self-efficacy (Sun et al., 2020; Wang & Tsai, 2020), school performance, and school attachment (Liu & Flick, 2019). In this context, Gutiérrez et al. (2018) point out that perceived autonomy support is a factor that increases students’ success through academic self-efficacy and school participation. Another study demonstrates an intermediary effect of psychological need satisfaction between stress and well-being (Aldrup et al., 2017). It has also been revealed that psychological need satisfaction helps students go through less stress (Zhou et al., 2020), anxiety (Maralani et al., 2016), and depression (Emery et al., 2015). Zhou et al. (2021) emphasized that basic psychological need satisfaction increases positiveness and academic success in adolescents. In this sense, it can be stated that psychological need satisfaction affects a person’s academic and social life. Therefore, in this study, psychological need satisfaction was considered an independent variable and thought that the students’ academic stress would decrease as psychological need satisfaction increased.

Psychological need satisfaction and academic stress

Academic stress is regarded as a rubric that expresses unpleasant psychological situations caused by the repression of education and examination systems and the high academic expectations for students of teachers and families (Sarita, 2015). Academic stress negatively affects physical and psychological health and is considered a factor in lowering students’ academic achievements (Sedere, 2010). Research findings show that students may be exposed to academic stress during activities that require high academic performance (Yu et al., 2016). Academic stress may occur more in departments with heavier course content and evaluation systems. In the given context, in an inquisition examining the differentiation of academic stress according to departments, and in a cross-sectional study examining the perceived academic stress level among medical, dentistry, psychology, and sports students, it is demonstrated that sports and psychology students have lower perceived stress risk compared to medical students (Neveu et al., 2012). Furthermore, students’ stress levels may be less at the beginning of their university years and higher in their senior year. The growing expectations for education, homework, and examinations can cause stress for college students. Considering that the students in the final year have a higher workload and the number of theoretical and applied courses to be accomplished, they are more likely to be exposed to stress in their senior year. Research findings show that educational stress may increase in the later years of the education process and towards the last years. In this context, as a result of a study on medical students, it was seen that educational stress is lower.
in the first grade and higher in recent years (Neufeld et al., 2020). So, using psychological resources to meet the increasing educational demands in senior years may be effective in reducing their stress levels. On the contrary, it is possible for students to be exposed to stress during their first year of university. Trying to get used to a new environment, getting used to living away from their family, and being able to be accepted in the social environment can bring about intense stress in individuals. Therefore, it is thought that it is crucial to examine the determination of academic stress, which has the potential to negatively affect the academic success of college students and the factors that will reduce the stress. In the meantime, as the academic stress increases, depression and level of anxiety also increase (Kuo et al., 2018) and the students undergo much more disconfirming emotions. In this context, Polat and Özdemir (2018) state that academic stress and school burnout are significant predictors of students’ alienation from school (Gibbons, 2012). Accordingly, it is accepted that determining the causes of academic stress in students and revealing the variables that will reduce academic stress are also essential for increasing academic success and connecting students to school. In research regarding factors that reduce academic stress, studies concerning components of psychological need satisfaction are remarkable.

A low level of satisfaction in autonomy, competence, and relatedness components of psychological needs both hampers human growth and causes negative emotions such as depression (Emery et al., 2015), burnout (Cho & Jeon, 2019), and stress (Naylor, 2020). By satisfying these three psychological needs, individuals’ level of achievement and coping with stress may boost, and accordingly, they may experience less stress. Academic stress typically occurs when educational requirements exceed an individual’s coping resources (Wilks, 2008). The satisfaction of three needs may help students to overcome these demands as an adaptive resource. Self-determination theory claims that satisfaction of three needs is associated with lower stress incursion (Ryan & Deci, 2000). Similarly, Weinstein and Hodgins (2008) claim that the basic psychological need satisfaction could act as a defensive response that assists in regulating and maintaining positive outcomes following stress exposure. A study conducted by Neufeld et al. (2020) showed a negative association between basic psychological need satisfaction and perceived stress, thus indicating a stress-protective role of basic psychological need satisfaction in medical students. Another case demonstrates that psychological need satisfaction mediates the relationship between exposure to stress and well-being (Aldrup et al., 2017). Travis and Bunde (2020) also found a significant negative relation between psychological need satisfaction and stress. Zhou et al. (2020) have shown that the relationship between autonomy, competence, relatedness need satisfaction, and stress is negatively paced. In this connection, in a study regarding the relationship between autonomy support and academic stress, the conclusion was that self-arranged learning and goal-oriented mediate this relationship (Zheng et al., 2020). Research findings suggest that psychological need satisfaction components are considered a factor in reducing students’ academic stress and increasing their achievements.

Psychological need satisfaction is a highly compatible and complementary motive that helps students to accomplish their developmental tasks. Given that college students are in the emerging adulthood period which has many social and psychological aspects that need to be accomplished, the satisfaction of autonomy, competence, and relatedness needs boosts adjustment and well-being. University students have different academic, social, and psychological development tasks and periods every year. The freshmen and the juniors have to adjust a new social environment, to make new friendships, and to succeed academic tasks. At this developmental process, the satisfaction of autonomy, competence, and relatedness and high level of satisfaction means for students have a high level of well-being and successful academic and social life. Neufeld et al. (2020) indicated that students’
autonomy and competence satisfaction and dissatisfaction were higher in senior years. So, in the current study, we choose a socio-demographically diverse sample including a different class, department, and faculty.

**The mediating role of grit and academic self-efficacy**

Grit is an individual’s determination and effort to achieve their long-term goals and be successful against the handicaps they face (Duckworth et al., 2007). It is stated that students with higher grit levels use more functional coping mechanisms for the obstacles they are facing and are more academically successful (Ivcevic & Brackett, 2014). According to the study results, we can say that grit has the potential to increase students’ academic success, and it has a protective and preventive effect in dealing with problems.

Gritty students go on relentlessly regardless of the handicaps they face (Duckworth et al., 2007). A study regarding this context highlights that psychological need satisfaction is a variable improving students’ grit levels (Jin & Kim, 2017). At the same time, it was stated that the predictive effects of fundamental psychological needs and grit were crucial in predicting well-being in adolescents (Akbag & Ümmet, 2017). As grit is the determination level of an individual in achieving goals, one can say a person with satisfying psychological needs can show more grit. With the increase in psychological need satisfaction, students feel more autonomous and competent and are more successful in their social relations. It can also help students to become more determined. Since individuals with a high level of psychological need satisfaction can act autonomously, they can be successful in determining their future goals themselves and become more willing to reach these goals in the future. At the same time, another component, competence, reveals the individual’s belief in their own capacity, so the individual who sees themselves as self-sufficient can also see themselves as sufficient to achieve their future goals. This, in turn, can increase the level of grit characterized by decisive action to achieve their goals. Thus, if the level of students’ basic psychological need satisfaction increases, their level of grit may also increases as well. Thus, the study by Yoon et al. (2020) defined that students with high autonomy support also have high grit levels. Pupils with exalted psychological need satisfaction can both see their competence higher and act more autonomously, which can help individuals show determination for achieving their goals. Also, if the students consider themselves sufficient to accomplish their dreams, their grit level can go up.

Numerous researches indicated that gritty students experience less depression (Datu et al., 2019), higher well-being (Jiang et al., 2020; Jin & Kim, 2017), more positive emotions, fewer negative emotions (Singh & Jha, 2008), and higher academic success (Ivcevic & Brackett, 2014). Furthermore, the more grit the students have, the less stress they experience. Students who work tirelessly on the path they set and in line with the goals they set can organize the learning process and have a high level of motivation. This may cause students to experience less stress in the learning process. In the same context, in a study by Lee (2017), it was stated that the students go through less stress with a rising grit level than before. Another research shows that grit is a preventive factor for dealing with stress (Mosanya, 2019). Therefore, increasing grit can be evaluated as a stress-reducing factor.

Grit includes the individual’s determination to reach their goals, working tirelessly and striving resolutely to reach their goals (Duckworth et al., 2007). Therefore, the level of grit can be expected to be higher at the stage where the individual strives to achieve their future goals. The high level of determination of the individual, especially in the last class, in order to be successful in the vocational transition exams based on placement with a central score.
may be effective in making them successful. Therefore, the high level of grit of the students in the last year can be an effective source both in their success and in reducing their stress. At the same time, the high level of determination at the beginning of the university years is important for students to achieve a certain high grade point average. Students must have a certain level of grades in order to be able to take courses from the next year and not to repeat the semester. Therefore, being determined in the first and following years may have a function that increases success and helps transition to a higher class.

Another factor that helps students increase their academic success and experience less stress is academic self-efficacy. Academic self-efficacy consists of students perceiving their competencies equally with the skill level required by the activity while trying to achieve academic activities (Bong & Skaalvik, 2003). In other words, students with a high level of academic self-efficacy also have higher expectations about academic activities in school (Putwain et al., 2013). As academic self-efficacy expands, students’ commitment to school (Stubbs & Maynard, 2017), academic success (Putwain et al., 2013), and psychological well-being (Asghari et al., 2014) also increase, and stress levels decrease (Travis & Bunde, 2020; Zajacova et al., 2005). Hence, students who feel competent academically undergo less stress and become more successful. At the same time, the importance of satisfying psychological needs in the formation of students’ academic self-efficacy was highlighted (Travis & Bunde, 2020). Individuals become more competent, particularly with the satisfaction of autonomy competence needs, which are included in psychological need satisfaction. They perceive their competence at a level to perform the activity (Buch et al., 2015; Oriol-Granado et al., 2017). In other words, as psychological need satisfaction increases, academic self-efficacy also increases. Therefore, it can be said that academic self-efficacy has an aspect that reduces academic stress and an element that is affected by psychological need satisfaction. Thus, in this research, regarding whether grit and academic self-efficacy will play a mediating role in reducing students’ academic stress, these two variables were included in the research as mediator variables.

Academic self-efficacy may differ from student department and class levels. There were research results that indicate students’ academic self-efficacy beliefs vary in numerous sociodemographic variables. Turgut (2013) found a significant differentiation between grade level and academic self-efficacy which freshman, sophomore, and junior students’ academic self-efficacy is the highest level when their GPA is the maximum level. Satici and Can (2016) found that academic self-efficacy significantly differs according to grade level and the senior students’ academic self-efficacy was higher than freshmen, juniors, and sophomores respectively. This study also reveals that students’ academic self-efficacy differed from their fields of study which are tech & sci, social, health, and art respectively. The first year of university education students has to deal with many educational and social stimuli. The following years mean for students both educational and job-related exams, so senior students need to be more self-efficient with the help of growing academic knowledge and required intern education. So, academic self-efficacy may be different for each year of university students.

**Purpose of the research and hypotheses**

Turkish undergraduate university students are faced with many stress-related stimuli while trying to achieve academic activities. The students challenge many theoretical and practical courses in teaching activities, and after completing their undergraduate education, they try to get ready for central exams such as Public Personnel Selection Exam (PPSS) or Medical
Specialization Exam (MSE) to meet the conditions for entry into the profession. They can experience academic stress both during their undergraduate studies and at the stage of preparation for the central exams after completing their undergraduate studies. For many students, university education means getting used to living in another city, developing positive and harmonious social relations with their surroundings, participating in theoretical and practical training, developing projects, and succeeding in academic and social activities such as preparing for exams. Positive resources of the individual in the realization of these activities can have a protective and preventive function in reducing stress levels. In this context, it can be said that individuals who become more autonomous, competent, and satisfied in their relationships by meeting their basic psychological needs will successfully organize their learning process. At the same time, based on the research findings that the satisfaction of psychological needs reduces stress (Neufeld et al., 2020), one can say students will be more successful in reducing their academic stress by satisfying these basic needs. At the same time, university students’ autonomous learning, self-efficacy, grit, and academic self-efficacy levels may also be positively affected by satisfying these three needs. While trying to achieve academic activities, it is important for the students who have passed the theoretical and practical training, who try to pass many staged exams, to see themselves as competent and to reach their goals with determination, in terms of experiencing less stress.

Knowing the coping methods of university students against stress is the first step in developing involvement methods in this context. There is increasing proof of psychological conditions such as depression and stress that university students experience in their educational life, which cause many negative outcomes such as school dropout, burnout, and academic failure (Hunt & Eisenberg, 2010; Jiang et al., 2021; Thomas & Shanafelt, 2006). Turkish university education is a long and challenging process. Reasons like curriculum density, information overload, academic competition, exams, and high-performance expectations cause stress in college students (Dvořáková et al., 2018). Diagnosing stress in college students and learning about the mediating roles are as crucial as developing health-promoting and stress-preventing interventions. The research was conducted on college students who are thought to undergo more intense stress.

In this context, when the studies on psychological need satisfaction and related literature are evaluated together, it is observed that psychological need satisfaction, consisting of autonomy, competence, and relatedness, may increase an individual’s success and academic self-efficacy may decrease academic stress in school, considering that psychological need satisfaction is a component that boosts an individual’s success, lowers their stress, makes them feel competent in achieving success in academic activities, and promotes their learning motivation. With the role of psychological need satisfaction, students’ probability of experiencing success, well-being, and positive emotions escalates, and they go through less stress in the academic field. In this respect, one can say when students’ psychological need satisfaction increases, their academic success also increases, and they will make significant contributions to reducing the stress that can be experienced in the academic environment. At the same time, it has been thought that grit and academic self-efficacy positively affect students’ academic achievement and reduce academic stress. There were numerous research results that highlighted the importance of self-determination theory on academic stress but little has been indicated in a sample of faculty of educational, theology, and medical students together. Therefore, this study aims to determine the mediating role of grit and academic self-efficacy in the relationship between psychological need satisfaction and academic stress in preclinical medical students, educational students, and theology students.
Basic psychological need satisfaction is linked with self-efficacy, and might also affect the evaluation of stress-related appraisals (Travis & Bunde, 2022). Including academic self-efficacy and grit variables might boost academic achievement by hindering stress-related appraisals. There were numerous research results that highlighted the importance of self-determination theory on academic stress but, to our knowledge, little has been indicated in the context of educational, theology, and medical students’ samples together. Since pre-clinical medical students come across highly intensive academic schedules before clinical practices, overloading academic activities may cause stress-related experiences (Neufeld & Malin, 2019). Similarly, education and theology students have been through both academically intense programs and job-related entrance exams. This academic process means for undergraduate students have heavy expectations, a long time to study, and endless exams. Given the academic expectations and program components with the help of satisfaction of autonomy, competence and relatedness may decrease undergraduate students’ academic stress with academic self-efficacy and grit.

The current study contributes to the literature in two ways: First, we report the mediator effect of grit and academic self-efficacy in the relationships between basic psychological need satisfaction and academic stress in a demographically diverse sample of Turkish undergraduates, drawn from a variety of departments, socioeconomic statues, and student classifications. Second, the indirect impact of basic psychological need satisfaction components on academic stress is modeled separately with autonomy, competence, and relatedness components, and a well-established self-regulatory construct such as academic self-efficacy and grit, as distinct constructs, has been relatively understudied in the academic context. A better understanding of the direct and indirect effect of basic psychological need satisfaction on academic stress with cognitive mediators could help undergraduate students and instructors to realize the importance of reducing stress with autonomy, competence, and relatedness components as well as grit and academic self-efficacy. This current study also helps the practitioners who may also design a psychoeducation program to hinder stress with basic psychological need satisfaction components with cognitive constructs such as grit and self-efficacy.

Since psychological need satisfaction has three sub-dimensions, autonomy, competence, and relatedness, and a total score could not be obtained from the scale, a separate model was created for each sub-dimension. For this purpose, the research questions are as follows and the proposed hypothesized model is in Fig. 1:

![Hypothesized model](image-url)
1. How strong is the mediator role of grit and academic self-efficacy in the relationship between autonomy and academic stress?

2. How strong is the mediator role of grit and academic self-efficacy in the relationship between competence and academic stress?

3. How strong is the mediator role of grit and academic self-efficacy in the relationship between relatedness and academic stress?

**Method**

**Research design**

This research was designed in the scope of relational studies. Through serial mediations, it examines the relationships between psychological need satisfaction, grit, academic self-efficacy, and academic stress variables in college students. In relational studies, the direction of the relations between the variables and the relation level is considered. These studies are also carried out to explain human behaviors and predict the possible consequences of these behaviors (McMillan & Schumacher, 2010).

**Ethical permission**

The ethical permission for the study was taken from the Ataturk University Faculty of Medicine Non-Interventional Research Ethics Committee (Date: 30.12.2021, Issue: 09/24). The study was conducted according to the Principles of the Declaration of Helsinki.

**Participants**

The study was conducted on 995 undergraduate students of the Faculty of Medicine, Faculty of Education, and Faculty of Theology. In sample choosing, a convenient sampling method was used. In the convenient sampling method, the researcher opts for accessible and appropriate individuals for the study (McMillan & Schumacher, 2010). But, it restricts the generalization of the study results and representation of sample. To eliminate these biases, we tried to reach different gender, age, city, faculty, university, success, and grade level of students. Participants’ characteristics are given in Table 1.

Table 1 demonstrates that 526 (54%) of the study group students are female, and 441 (46%) of them are male students. Four hundred four (41.8%) of the students are freshmen, 380 (39.9%) are sophomores, 54 (5.6%) are juniors, and 129 (13.3%) are seniors. The mean average age of the study group was 20.69, and the standard deviation was 2.39. The rates of participations were 73% for the Faculty of Medicine preclinical students (769/1055), 67% for the Faculty of Education (175/262), and 85% for the Faculty of Theology (23/27). Participants were studying at university 1st, 2nd, and 3rd class in 2021–2022 autumn semester for medical students and 1st, 2nd, 3rd, and 4th class in 2021–2022 summer semester for education and theology faculty. The education faculty and the theology faculty students were taking lessons from the researchers’ summer semester class.
Materials

A short sociodemographic information form, balance in psychological need satisfaction scale, academic stress scale, brief grit scale, and perceived academic self-efficacy scale were used as data collection tools. In the sociodemographic information form, the students were asked about age, gender, and class information.

Balance in psychological need satisfaction scale

This is a scale of 18 items improved by Sheldon and Hilpert (2012) adapted to the Turkish version by Kardaş and Yalçın (2018) and aims to measure individuals’ satisfaction and frustration level psychological needs according to the 5-point Likert system. The analysis results for the scale’s validity demonstrated that both three-dimensional and six-dimensional factor structures were verified in the Turkish sample (three-factor form accordance indices $\chi^2/sd = 2.92$, RMSEA = 0.08, RMR = 0.05, GFI = 0.87, CFI = 0.92, NFI = 0.89, NNFI = 0.91; six-factor form accordance indices $\chi^2/sd = 1.43$, RMSEA = 0.04, RMR = 0.04, GFI = 0.94, CFI = 0.98, NFI = 0.94, NNFI = 0.98).

Since the total score could not be received from the scale, the scale’s reliability was examined according to the sub-dimensions. The research sample determined that the Cronbach alpha reliability coefficient was 0.74 for the autonomy sub-dimension, 0.78 for the competence sub-dimension, and 0.61 for the relatedness sub-dimension. McDonald omega’s credibility was found to be 0.74 for the autonomy sub-dimension, 0.80 for the competence sub-dimension, and 0.63 for the relatedness sub-dimension. It can be stated that the credibility rate of the relatedness sub-dimension of the scale is a little lower than the acceptable limit.

Table 1 Sample characteristics

| Sociodemographic characteristics | N   | %  |
|----------------------------------|-----|----|
| Gender                           |     |    |
| Female                           | 526 | 54 |
| Male                             | 441 | 46 |
| Class                            |     |    |
| 1st                              | 404 | 41.8|
| 2nd                              | 380 | 39.9|
| 3rd                              | 54  | 5.6 |
| 4th                              | 129 | 13.3|
| Faculty                          |     |    |
| Medicine                         | 769 | 80 |
| Education                        | 175 | 18 |
| Theology                         | 23  | 2  |
| University                       |     |    |
| Atatürk University               | 942 | 97 |
| Other universities               | 25  | 3  |
| Perceived socioeconomic status   |     |    |
| Low                              | 98  | 10 |
| Middle                           | 820 | 85 |
| High                             | 49  | 5  |
Educational stress scale

It is a 16-item scale improved by Sun et al. (2011) and adapted to the Turkish version by Celik et al. (2014). The scale has a five-agent structure: work pressure, workload, grade anxiety, self-expectation, and hopelessness. Scale items are answered and scored according to a 5-point Likert system (1—strongly disagree, 5—strongly agree). The score that can be acquired from the scale is between 16 and 80. Also, points of sub-dimensions can be evaluated, too. Cronbach alpha internal consistency reliability parameter was found to be 0.81 for the whole scale. Celik et al. (2014) made an adaptation to the Turkish version, and its psychometric features were illustrated. Cronbach alpha rate of the Turkish version of the scale was found to be 0.83 for the whole scale. Results about the scale’s validity showed that it has acceptable accordance indices for the five-agent structure.

Brief grit scale

It is a self-evaluation scale developed by Duckworth and Quinn (2009) and adapted to Turkish by Sarıçam et al. (2016). The scale, consisting of 8 items, has a structure of two dimensions, which are (1) consistence of interest and (2) insistence on effort. The themes of the scale are answered (1—Not meant for me, 2—A very little meant for me, 3—A little meant for me, 4—Quite meant for me, 5—Meant for me) and graded according to the 5-point Likert scale.

The Cronbach alpha internal consistency reliability coefficients for the whole scale were found to be 0.82. The Cronbach alpha value of the Turkish scale version was 0.83 for the whole scale. It has been informed that the scale is an acceptable and reliable measuring tool that can evaluate individuals’ grit, determination, persistence, and insistence levels. The confirmatory factor analysis results of the scale revealed that the form accordance indices showed a perfect fit ($\chi^2$/sd = 2.06, $p = 0.000$, RMSEA = 0.046, CFI = 0.95, GFI = 0.94, AGFI = 0.93, SRMR = 0.047).

Perceived academic self-efficacy scale

The perceived academic self-efficacy scale, improved by Jerusalem and Schwarzer (1981) and adapted to Turkish by Yılmaz et al. (2007), is a 7-agent scale that evaluates students’ beliefs about finishing an academic work successfully. The Cronbach alpha reliability value of the scale was 0.87 in the original study and 0.79 in the Turkish version. As in the original scale, there are seven items in a single dimension in the Turkish version. Scale items are answered on a 4-point Likert system (fully suited to me, suited to me, very little suited to me, not at all).

Process of data collection

The research was conducted between 10/01/2022–25/01/2022 and 25/07/2022–05/08/2022. Since the pandemic and online education process were still the cases on these dates, the questionnaire form was prepared on Google Forms. After the students were informed about the purpose and scope of the research, they were invited. The questionnaire link was shared on WhatsApp student groups. Volunteerism was the basis for participation in the study. The students were given 2 weeks to complete the questionnaire. Two reminder messages
were sent during this period. At the end of the period, the questionnaire was closed for answers.

In online data collection, it is recommended to use attention checks to reduce the bias of participants’ responses to scale items. Similarly, increasing the representativeness of the sample and adding explanatory scale items are among the suggestions (Newman et al., 2021). In the current study, the power of representing the universe was tried to be increased by trying to reach a diverse sample group such as different classes, faculties, universities, regions, and socioeconomic levels. In the first section of the data collection tool, with informed consent, detailed instructions were presented and information was added about the purpose of the research, possible risks, no need for any identity information, and withdrawal options. Then, an attention check has been added for them to read and accept the information. The first question of the questionnaire was “I voluntarily agree to participate in the study.” and it was planned in a way that the participants could continue only when they gave this consent. Thus, the students’ permission was taken online. Those who did not give this first permission could not reach the other questions. The data was collected anonymously. There were not any personal info questions. Each process took 2 weeks to collect the data.

Common method bias

During the data collection phase, the students filled the scales according to self-report. However, during this phase, students may mark incorrectly when filling out the scales due to conditions such as fatigue, distraction, getting approval, or misreading the scale items (Podsakoff et al., 2003). This situation is considered a common method bias and negatively affects the validity of the research. To reduce the common method bias in this study, the researchers used Harman’s single factor test. Harman’s single factor test includes collecting all the variables in the research under a single factor and explaining the variables below 50% of the total variance (Harman, 1976). In this study, since it was determined that the variables were gathered under a single factor and the explained variance was 21%, it indicated that there was no common method bias problem.

Normality analysis

Before proceeding to the mediation analysis, we examined the suitability of the data to the univariate and multivariate normal distribution. Firstly, we calculated the skewness and kurtosis values. It has been noted that the skewness and kurtosis value is between $[-1.5, +1.5]$ which is a criterion related to distribution normality (Tabachnick et al., 2007). Given that the values of the skewness and kurtosis levels are in the range between $-0.01$ and 0.17, it was concluded that the data has univariate normality. In addition, normality of regression errors was the calculated skewness and kurtosis values $-0.01–0.17$ respectively. Secondly, in determining the multivariate normality, 28 data that violated the multivariate normality were excluded from the data set. Mardia’s coefficient was calculated below 20, $p < 0.01$, for multivariate normality. It is suggested for Mardia’s multivariate kurtosis values of critical ratio that a lower than 10 is an acceptable degree for multivariate normality (Kline, 2015). It is considered an acceptable level for multivariate normality with a lower than 20 (Gurbuz, 2016). For the five predictor variables, the Mahalanobis coefficient did not have an outlier value exceeding the $p < 0.01$ significance level. After evaluating the multivariate normality of the data set by examining Mahalanobis, tolerance, and variance
inflation factor (VIF) values, it was concluded that the data set also has multivariate normality, and an analysis of the data was started to carry out. In determining the relationships between the variables in the data analysis, Pearson product-moment correlation analysis, serial mediation analysis (Hayes, 2017), and bootstrap confidence interval methods were used. The analysis process was carried out through SPSS 24, Amos Graphics 22, and SPSS Process 3.5 macros.

The high level of correlation between the variables points to the multicollinearity problem (Kline, 2011). In this context, since the correlations between the variables were observed to be between −0.31 and 0.61, it was determined that the variables were not highly correlated to form a multicollinearity. Furthermore, the tolerance value should not be less than 10, and the VIF (variance inflation factor) value should not be greater than 10 (Kline, 2011). Tolerance ranges from 0 to 1 and is associated with each independent variable. Although there is not a strict cutoff for tolerance value, Allison (1999) suggests a tolerance of below 0.40 is cause for concern. Similarly, Weisburd and Britt (2013) state that anything under 0.20 suggests serious multicollinearity in a model. As it was determined that the tolerance values were between 0.48 and 0.72 and the VIF values were between 1.39 and 2.10, it was concluded that there was no multicollinearity problem.

Validity and reliability of the scales

Confirmatory factor analysis and reliability analyses were conducted to determine that the scales used in the study produced valid and reliable results in the research sample, and the results are given in Table 2.

When Table 2 is examined, it is seen that the validity and reliability results of the scales used in the study also have valid and reliable results in the research sample of the rankings. Accordingly, when the validity results of the scales are evaluated, it is noticed that their form accordance indices are within acceptable value ranges. According to the reliability results of the rankings, as it was determined that the reliability coefficients of Cronbach alpha and McDonald omega ranged between 0.77 and 0.86, it can be stated that in this research, sample scales produce an adequate amount of valid and reliable results.

Results

Preliminary analysis

Correlation analysis results are given in Table 3.

Table 2  Results of the validity and reliability analysis of the scales

| Scales                                 | \( \chi^2 \) | df | \( \chi^2/df \) | SRMR | RMSEA [95% CI] | CFI | TLI | \( \alpha \) | \( \Omega \) |
|----------------------------------------|--------------|----|----------------|------|----------------|-----|-----|-------------|------------|
| Balance scale in psychological need satisfaction | 708.40       | 124| 5.71 .07       | .07  | .06–.08        | .89 | .87 | *           | *          |
| Academic stress scale                  | 754.90       | 98 | 7.70 .06       | .08  | .07–.09        | .89 | .86 | .86         | .86        |
| Brief grit scale                       | 123.91       | 16 | 7.93 .06       | .08  | .07–.09        | .94 | .90 | .77         | .77        |
| Perceived academic self-efficacy scale | 90.19        | 13 | 6.94 .03       | .07  | .06–.09        | .97 | .95 | .82         | .84        |
When Table 3 is examined, it is seen that there was a negative statistically significant relationship between autonomy ($r = -0.48$), competence ($r = -0.41$), and relatedness ($r = -0.31$), which are the components of psychological need satisfaction and academic stress. There was a positive, statistically significant intermediate relationship among autonomy ($r = 0.50$), competence ($r = 0.61$), relatedness ($r = 0.40$), and grit, and there was a positive, intermediate relationship between autonomy ($r = 0.38$), competence ($r = 0.55$), relatedness ($r = 0.25$), and academic self-efficacy. These findings showed that when autonomy, competence, and relatedness, which are components of psychological need satisfaction, increased, grit and academic self-efficacy also increased, but academic stress decreased, and this relationship was moderate.

**Measurement model**

Before proceedings of the mediation analysis, we examined the measurement model that has acceptable fit indexes ($\chi^2 = 906.87$, $df = 109$, $p = 0.000$, RMSEA = 0.08, CFI = 0.88, GFI = 0.90, SRMR = 0.07). Figure 2 demonstrates the value of observed variables and estimated factor loadings of measurement model. Basic psychological need satisfaction has three components of autonomy, competence, and relatedness; academic stress has five sub-dimensions; grit has two sub-dimensions; and academic self-efficacy consists of seven items. All estimated factor loadings are statistically significant at a level of 0.01.

**Mediation analysis results**

To test the study’s hypothesis, mediation analysis was made according to Hayes’s (2017) recommendation of model 6. The hypothesis model was tested with three different comments because the study’s independent variable, psychological need satisfaction, has a three-dimensional structure that needs to be dealt with separately and consists of autonomy, competence, and relatedness. The study’s mediation analysis results are given in Table 4 for the autonomy model, Table 5 for the competence model, and Table 6 for relatedness model.

* \( p < .001, N = 967 \)
As seen in Table 4, the direct effect of the first component of psychological need satisfaction, autonomy, on academic stress was significant ($B = -0.97$, SE = 0.08). The direct effect of autonomy on mediator variable, grit ($B = 0.60$ SE = 0.03) and academic
Table 4 Mediating role of grit and academic self-efficacy between autonomy and academic stress

| Predictor variables       | Grit                          | Academic self-efficacy | Academic stress |
|---------------------------|-------------------------------|------------------------|-----------------|
|                           | B    | SE  | β   | B    | SE  | β   | B    | SE  | β   |
| Autonomy                  | .60  | .03  | .50 | .21  | .04  | .18 | -.97 | .08  | -.37 |
| Grit                      |     |     |    | .37  | .03  | .39 | -.29 | .07  | -.13 |
| Academic self-efficacy    |     |     |    | -.24 | .07  | -.10|       |      |     |
| Constant                  | 14.20| .71  | -   | 9.73 | .80  | -   | 82.35| 1.96 | -   |
|                           | $R^2 = .25$                    | $R^2 = .26$            | $R^2 = .26$     |
|                           | $F(1,964) = 320.53^{**}$       | $F(2,964) = 170.98^{**}$| $F(3,963) = 112.85^{**}$ |

**$p < .001$**
Table 5 Mediating role of grit and academic self-efficacy between competence and academic stress

| Predictor variables | Outcome variables | Grit | Academic self-efficacy | Academic stress |
|--------------------|-------------------|------|------------------------|-----------------|
|                    |                   | B    | SE | β | B | SE | β | B | SE | β |
| Competence         |                   | .76  | .03 | .61 | .49 | .04 | .41 | −.70 | .11 | −.26 |
| Grit               |                   | -    | -  | -   | .23 | .03 | .24 | −.38 | .08 | −.17 |
| Academic self-efficacy |               | -    | -  | -   | -   | -   | -   | −.19 | .08 | −.08 |
| Constant           |                   | 9.90 | .72 | -   | 7.30 | .77 | -   | 78.87 | 2.01 | -   |
| $R^2 = .37$        |                   | $R^2 = .34$ |      | $R^2 = .20$ |
| $F(1,965) = 561.70^{**}$ |               | $F(2,964) = 249.98^{**}$ |      | $F(3,963) = 78.48^{**}$ |

**p < .001
The mediating role of grit and academic self-efficacy in the relationship between relatedness and academic stress

| Predictor variables          | Outcome variables | Grit                  | Academic self-efficacy | Academic stress |
|-----------------------------|-------------------|-----------------------|------------------------|----------------|
|                             |                   | $B$ | $SE$ | $\beta$ | $B$ | $SE$ | $\beta$ | $B$ | $SE$ | $\beta$ |
| Relatedness                 |                   | .60 | .05  | .40     | .10 | .04  | .07     | -.59 | .11  | -.18   |
| Grit                        |                   | -   | -    | -       | .44 | .03  | .46     | -.49 | .08  | -.22   |
| Academic self-efficacy      |                   | -   | -    | -       | -   | -    | -       | -.36 | .08  | -.16   |
| Constant                    |                   | 12.33 | 1.08 | -       | 10.08 | 1.05 | -       | 84.33 | 2.57 | -     |

$R^2 = .16$

$F(1,965) = 178.97^{**}$

$R^2 = .24$

$F(2,964) = 152.63^{**}$

$R^2 = .19$

$F(3,963) = 73.75^{**}$

**$p < .001$**
self-efficacy ($B = 0.21$, SE = 0.04), was also proved to be significant. It has been determined that the direct effect of one of the mediator variables, grit on the dependent variable on academic stress ($B = -0.29$, SE = 0.07), and the direct effect of the other mediator variable, self-efficacy on the dependent variable academic stress, are also significant ($B = -0.24$, SE = 0.07).

Regression analysis based on the bootstrap method was performed to determine if the mediating role of grit and academic self-efficacy in the relationship between autonomy and academic stress is significant. According to the confidence intervals obtained by the bootstrap method, the mediating role of grit and academic self-efficacy between autonomy and academic stress is statistically significant ($B = -0.05$, SE = 0.02, 95% CI $[-0.09, -0.02]$). As the bootstrap lower and upper confidence intervals did not include 0, it was seen that the mediation effect was significant.

Figure 3 also indicates a partial mediator role of grit and academic self-efficacy in the relationship between autonomy and academic stress ($B = -0.05$, SE = 0.02, 95% CI $[-0.09, -0.02]$). Since the level of the relationship between autonomy and academic stress decreased with the addition of grit and academic self-efficacy to the model, there is a partial mediation of grit and academic self-efficacy in the relationship between autonomy and academic stress.

**Competence model**

As seen in Table 5, the direct effect of competence, the second component of psychological need satisfaction, which is the independent variable of the model, on academic stress was significant ($B = -0.70$, SE = 0.11). Also, it was determined that the direct effect of competence on mediator variable grit ($B = 0.76$, SE = 0.03) and academic self-efficacy ($B = 0.49$, SE = 0.04) was also significant. It was also noted that both the direct effect of a mediator variable, grit on a dependent variable, academic stress ($B = -0.38$, SE = 0.08), and the direct effect ($B = -0.19$, SE = 0.08) of a mediator variable, academic self-efficacy on a dependent variable, academic stress, were significant.

Regression analysis based on the bootstrap method was conducted to determine if grit and academic self-efficacy have a significant mediating role in the relationship between

![Diagram showing the mediation analysis result of autonomy model](image-url)
competence and academic stress. According to the confidence intervals obtained by the bootstrap method, it was observed that the mediation effect of grit and academic self-efficacy, together with competence and academic stress, was statistically significant ($B = -0.03$, SE = 0.02, 95% CI $[-0.07, -0.00]$). Since the bootstrap lower and upper confidence intervals did not include zero, it was seen that the mediation effect was significant.

Figure 4 also indicates a partial mediator role of grit and academic self-efficacy in the relationship between competence and academic stress ($B = -0.03$, SE = 0.02, 95% CI $[-0.07, -0.00]$). Since the level of the relationship between competence and academic stress decreased with the addition of grit and academic self-efficacy to the model, there is a partial mediation of grit and academic self-efficacy in the relationship between competence and academic stress.

**Relatedness model**

As seen in Table 6, the third component of psychological need satisfaction, relatedness, an independent variable of the modal, had a significant direct effect on academic stress ($B = -0.59$, SE = 0.11). At the same time, it was determined that the direct effect of relatedness on the mediating variables of grit ($B = 0.60$, SE = 0.05) and academic self-efficacy ($B = 0.10$, SE = 0.04) was also significant. The direct effect of grit, one of the mediating variables, on academic stress, a dependent variable ($B = -0.49$, SE = 0.08), and the direct effect of academic self-efficacy, another mediator variable, on the dependent variable, academic stress ($B = -0.36$, SE = 0.08), were determined to be significant.

To determine if the mediating role of grit and academic self-efficacy in the relationship between relatedness and academic stress is significant, regression analysis, based on the bootstrap method, was conducted. According to the bootstrap confidence intervals, the mediating effect was significant in the relationship between grit, academic self-efficacy, and academic stress ($B = -0.10$, SE = 0.02, 95% CI $[-0.15, -0.05]$). As the bootstrap lower and upper confidence intervals did not include zero, the mediation effect was significant.

Figure 5 also indicates a partial mediator role of grit and academic self-efficacy in the relationship between competence and academic stress ($B = -0.10$, SE = 0.02, 95% CI $[-0.15, -0.05]$). Since the bootstrap lower and upper confidence intervals did not include zero, it was seen that the mediation effect was significant.

![Diagram](https://via.placeholder.com/150)

**Fig. 4** The mediation analysis result of competence model
Since the level of the relationship between relatedness and academic stress decreased with the addition of grit and academic self-efficacy to the model, there is a partial mediation of grit and academic self-efficacy in the relationship between relatedness and academic stress.

**Total, direct, and indirect effects**

After determining the mediating effect of psychological need satisfaction on academic stress through grit and academic self-efficacy, the total, direct, and indirect effects of the variables on each other were examined. The results of the total, direct, and indirect effects are given in Table 7.

When Table 7 is examined, it is seen that in the autonomy model, the total effect of autonomy on academic stress ($B = -1.24$, $SE = 0.07$, 95% CI $[-1.39, -1.10]$) and its direct effect ($B = -0.97$, $SE = 0.08$, 95% CI $[-1.13, -0.80]$) were significant. The total indirect effect of autonomy on academic stress ($B = -0.28$, $SE = 0.05$, 95% CI $[-0.37, -0.19]$) was also seen to be significant. It is seen that the indirect effect of autonomy on academic stress through grit ($B = -0.18$, $SE = 0.05$, 95% CI $[-0.28, -0.08]$) and academic self-efficacy ($B = -0.05$, $SE = 0.02$, 95% CI $[-0.09, -0.01]$) was also significant. In addition, since the standardized total indirect effect value was determined as $-0.11$, it is possible to say that grit and academic self-efficacy ($B = -0.05$, $SE = 0.02$, 95% CI $[-0.07, -0.00]$) have a medium mediating effect.

When Table 7 is continued to be examined, it is seen that the total effect of competence on academic stress ($B = -1.11$, $SE = 0.08$, 95% CI $[-1.26, -0.95]$) and its direct effect ($B = -0.69$, $SE = 0.11$, 95% CI $[-0.90, -0.49]$) are significant in the competence model. It is seen that the total indirect ($B = -0.41$, $SE = 0.08$, 95% CI $[-0.57, -0.26]$) effect of competence on academic stress is also significant. It is seen that the effect of competence on academic stress through grit ($B = -0.28$, $SE = 0.07$, 95% CI $[-0.43, -0.15]$) and academic self-efficacy ($B = -0.09$, $SE = 0.04$, 95% CI $[-0.18, -0.01]$) is also significant. At the same time, it is seen that the indirect effect of competence on academic stress through grit and academic self-efficacy ($B = -0.03$, $SE = 0.02$, 95% CI $[-0.07, -0.00]$) is significant. In addition, since the standardized total indirect effect value was determined as $-0.15$, it
is possible to say that grit and academic self-efficacy have a moderate mediating effect together.

When Table 7 is continued to be examined, it is seen that the total effect of relatedness ($B = -1.01, SE = 0.10, 95\% CI [-1.21, -0.82]$) and the direct effect ($B = -0.59, SE = 0.11, 95\% CI [-0.80, -0.38]$) on academic stress are significant in the relatedness model. It is seen that the total indirect effect ($B = -0.42, SE = 0.06, 95\% CI [-0.54, -0.32]$) of relatedness on academic stress is also significant. It is seen that the indirect effect of relatedness on academic stress through grit ($B = -0.29, SE = 0.06, 95\% CI [-0.41, -0.19]$) and academic self-efficacy ($B = -0.04, SE = 0.02, 95\% CI [-0.08, -0.00]$) is also significant. At the same time, it is seen that the indirect effect of relatedness on academic stress through grit and academic self-efficacy together ($B = -0.10, SE = 0.02, 95\% CI [-0.15, -0.05]$) is significant. In addition, since the standardized total indirect effect value was determined as $-0.13$, it is possible to say that grit and academic self-efficacy together have a moderate mediating effect.

It is seen that the highest effect on the total and direct effects of the components of psychological need satisfaction on academic stress is autonomy, competence, and relatedness, respectively.

In the autonomy model, grit was found to be significant mediator variable together with academic self-efficacy. The indirect effect of grit is higher than indirect effect of academic self-efficacy. It was observed that the combined effect of grit and academic self-efficacy

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**Table 7** Total, direct, and indirect effects of autonomy, competence, and relatedness components of psychological need satisfaction on academic stress

|                | $B$  | SE  | 95% CI          | $K^2$ |
|----------------|------|-----|-----------------|-------|
|                |      |     |                 |       |
| **Total effect** |      |     |                 |       |
| AAS            | -1.24| .07 | -1.39 to -1.10  |       |
| CAS            | -1.11| .08 | -1.26 to -0.95  |       |
| RAS            | -1.01| .10 | -1.21 to -0.82  |       |
| **Direct effect** |      |     |                 |       |
| AAS            | -0.97| .08 | -1.13 to -0.80  |       |
| CAS            | -0.69| .11 | -0.90 to -0.49  |       |
| RAS            | -0.59| .11 | -0.80 to -0.38  |       |
| **Total indirect effect** |      |     |                 |       |
| AAS            | -0.28| .05 | -0.37 to -0.19  | -0.11 |
| CAS            | -0.18| .05 | -0.28 to -0.08  |       |
| RAS            | -0.05| .02 | -0.09 to -0.01  |       |
| **Total indirect effect** |      |     |                 |       |
| AAS            | -0.41| .08 | -0.57 to -0.26  | -0.15 |
| CAS            | -0.28| .07 | -0.43 to -0.15  |       |
| RAS            | -0.09| .04 | -0.18 to -0.01  |       |
| **Total indirect effect** |      |     |                 |       |
| AAS            | -0.42| .06 | -0.54 to -0.32  | -0.13 |
| CAS            | -0.29| .06 | -0.41 to -0.19  |       |
| RAS            | -0.04| .02 | -0.08 to -0.00  |       |
| **Total indirect effect** |      |     |                 |       |
| AAS            | -0.10| .02 | -0.15 to -0.05  |       |

A, autonomy; C, competence; R, relatedness; AS, academic stress; G, grit; ASE, academic self-efficacy
was less than the indirect effect of grit alone. This finding shows that grit had a strong mediator effect on academic stress in the autonomy model.

In the competence model, it was seen that the total and direct effects of grit and academic self-efficacy were statistically significant. It is seen that the indirect effect of grit is higher than the indirect effect of academic self-efficacy. It has been observed that the combined effect of grit and academic self-efficacy is less than the indirect effect of grit and academic self-efficacy alone. It is seen that the indirect effect of academic self-efficacy in the competence model is higher compared to the autonomy model.

In the relatedness model, on the other hand, the total and direct effects of grit and academic self-efficacy were found to be significant. It is seen that the indirect effect of grit is higher than the indirect effect of academic self-efficacy. It has been observed that the combined effect of grit and academic self-efficacy is less than the indirect effect of grit and academic self-efficacy alone.

**Discussion, conclusion, and suggestions**

As a result of this research, in which the mediator role of grit and academic self-efficacy in the relationship between psychological need satisfaction and academic stress in students was determined, it is seen that the mediating effect of grit and academic self-efficacy in the relationship between psychological need satisfaction, consisting of autonomy, competence, and relatedness, and academic stress is statistically significant. The research findings were interpreted in line with the positive psychology literature.

The results of the first hypothesis model proposed after this research demonstrated that the mediating role of grit and academic self-efficacy together in the relationship between autonomy and academic stress is statistically significant. That indication from this research supports the other result of the studies conducted before in the literature. Lozano-Jiménez et al. (2021) discussed the effect of self-determined motivation and group conformity on the life satisfaction of autonomy support and grit in university students, undergraduate and graduate. The study showed that autonomy support and grit in teachers predicted psychological need satisfaction and internal motivation, which also increased group conformity and life satisfaction. A study by Aldrup et al. (2017) analyzed the mediating role of psychological need satisfaction in the relationship between being exposed to stress and well-being. The results demonstrated that psychological need satisfaction mediates the relationship between exposure to stress and well-being. Jin and Kim (2017) also introduced that psychological need satisfaction and grit have a significant positive relationship. Jiang et al. (2020) noted that psychological need satisfaction increases well-being with the help of grit. Jang et al. (2019) also showed a mediating and regulator effect of grit and daily stress on the relationship between fundamental psychological need satisfaction and academic burnout. Duchatelet and Donche (2019) put forth that attitude of the teachers who support autonomy increases self-efficacy in students with autonomous motivation. Freire et al. (2019) worked on the mediating role of self-efficacy between coping with stress and well-being. The results demonstrated that self-efficacy partially mediated the relationship between adaptive coping and stress strategy.

Considering the results, it can be stated that autonomy-supporting behaviors increase an individual’s self-efficacies; when psychological needs are satisfied, academic self-efficacy increases and stress levels are decreased. Therefore, studies in the literature and the current study have a lot in common. This study determined that in case of an increase in autonomy,
grit and academic self-efficacy increase, and the mediating effect of grit and academic self-efficacy together is significant between autonomy and academic stress. Now that they choose their learning environment and take more responsibility in their learning process, students may have become more determined about dealing with the problems they face during the learning process. Students, who feel stronger with higher autonomy, may have opted for fighting with difficulties more by taking more responsibility in the learning process. As they overcame numerous obstacles they ran into, their belief in their own efficacy increased, and as a result, they probably had less academic stress. This research also proved that when the students’ autonomy increased, their academic self-efficacy also increased simultaneously, and the mediating role of academic self-efficacy between autonomy and academic stress was found to be significant. Students who take responsibility for the learning process and organize the learning environment could see themselves as more competent academically. As a result of this process, the students could be exposed to less stress.

The results of the second hypothesis model proposed as a result of this research demonstrated that the mediating role of grit and academic self-efficacy in the relationship between competence and academic stress is statistically significant. This finding obtained as a result of the research supports the previous research in the literature. Orkaizagirre-Gómar et al. (2020) studied the relationship between nursing students’ perceived competence, self-efficacy, psychological resilience, and stress. Results of the study showed that competence, self-efficacy, and psychological resilience decrease stress levels and increase academic success. Fabelico and Afalla (2020) analyzed the teachers’ determination and ambition levels and self-efficacy, grit, burnout, and performances. Results showed that characteristics of teachers predict their performance with the help of grit, self-efficacy, and burnout. Jose and Manikandan (2019) approached the effect of self-efficacy, the working year, and gender on grit in medicine students. Results demonstrated that there is a significant positive relationship between grit and self-efficacy. Xu et al. (2021) showed a mediating role of self-efficacy and stressful life issues between parental control and a sense of consistency in Chinese adolescents. Zhou et al. (2020) showed that adolescent school stress decreases when psychological need satisfaction increases. Brando-Garrido et al. (2020) analyzed academic delaying, perceived competence, coping mechanism, self-respect, and self-efficacy in nursing students. The study showed that there are significant negative relations between academic delaying, perceived competence, coping mechanism, self-respect, and self-efficacy, and perceived competence is the significant predictor of academic delaying. Jeong and Jin (2020) demonstrated that there is a mediating role of grit in the relationship between fundamental psychological need satisfaction and well-being. Studies, on the whole, show that individuals who consider themselves competent enough go through less stress during the learning process, have higher levels of grit, and have more self-efficacy in academic activities. In this context, when the efficacy level increases, as the individual has control over their environment, they can act more determined in overcoming the obstacles they face. At the same time, students may be more successful in controlling academic stress with higher competence, a component of psychological need satisfaction, and higher self-efficacy.

The results of the third hypothesis model proposed as a result of this research revealed that the mediating role of grit and academic self-efficacy in the relationship between relatedness and academic stress is statistically significant. This indication obtained from the result of the research supports the other studies in a similar context in the literature. The study by Lyraakis (2012) discovered a significant positive relationship between the stress-coping skills of students and self-efficacy/self-respect. Clark et al. (2020) showed that students who perceive more social support from their teachers, parents, and peers have higher grit levels. Also, results showed a regulating effect of perceived social support
in the relationship between grit and academic success. In a study by Lee et al. (2021), it was determined that there is a significant positive relationship between social support and school coherence and grit variables in university students attending the nursing department. In Walakira and Kaddu’s (2018) study, the relationship between social support grit and depression in adolescents was examined. In a study conducted by Lee (2017), the relationship between academic performance, perceived academic failure, grit, and stress was examined. As a result of the research, it was seen that grit, which consists of the sub-dimensions of interest and determination, is negatively related to stress, and perceived academic failure is positively related to stress. As a result of the longitudinal research by Jumat et al. (2020) conducted on medical school students, it was revealed that grit is a factor that reduces the burnout of students. In a study by Lan (2020) on the relationship between peer relationships and grit in early adolescence, it was revealed that when peer relationships increase, grit increases too. Datu (2017) emphasized that in collectivist cultures, relatedness increases grit. Akbay and Gündüz (2020) determined a mediating role of self-efficacy, perceived social self-efficacy, and social anxiety in the relationship between peer support in adolescents and autonomy. According to the findings of the study, it was seen that at the same time, as peer support increases, social self-efficacy increases, social anxiety decreases, and as a result, autonomy increases. According to a study by Thornton et al. (2020), group conformity and positive social relations between students increase academic success and positively affect well-being. Results of this research showed that relatedness increases grit and academic self-efficacy of students and, as a result, decreases academic stress. Similarly, in the present study, it was seen that as the relatedness of medicine students increases, their stress levels decrease, and grit and academic self-efficacy played a mediating role in the relationship between these two variables. As the young people’s social relationships with their teachers, peers, and other individuals increase, their self-confidence increases, which may increase their academic self-efficacy. At the same time, the individual may have shown more grit in academic activities with the effect of positive social ties. As a result, considering their intense education life, their grit and academic self-efficacy may have increased through positive social relations. As a result, the stress levels of the students may have decreased.

Conclusion and suggestions

As a result of this research, it was determined that psychological need satisfaction, which consists of the components of autonomy, competence, and relatedness, has a significant effect on academic stress directly and indirectly through grit and academic self-efficacy. When evaluated in terms of the components of psychological need satisfaction, it was seen that the direct and total effects of academic stress were highest in the autonomy model. In the competence and relatedness model, the total indirect effect was found to be higher than the autonomy model. Accordingly, students’ autonomy explains the academic stress variable, but it has been determined that grit and academic self-efficacy, which are the mediating variables, have a very high indirect effect in the dimensions of competence and relatedness. This finding indicates that grit and academic self-efficacy should also be taken into account, apart from the psychological need satisfaction components, in reducing academic stress.

The current research results showed that grit and academic self-efficacy mediated the relationship between autonomy, competence, and relatedness, which are among the basic
psychological need satisfaction and academic stress of preclinical medical students, education faculty, and undergraduate students of theology faculty. These findings reveal the importance of considering constructs such as psychological need satisfaction, perseverance, and academic self-efficacy in preventive studies to reduce and prevent stress for this group, whose education program is intense and who are more likely to be exposed to stress.

As a result of this research that tries to clarify the academic stress in college students with mediating variables, the following suggestions can be made:

This study showed that increasing psychological need satisfaction decreases academic stress and increases grit and academic self-efficacy. Thus, learning environments of departments that have intense academic content and stressful learning conditions can be designed to support students’ autonomy. Classes can be continued with activities that aim to cooperate among students, support competition positively, and make students feel competent. Also, considering that grit is a mediating variable, the motivation of students that increases their determination and makes sure that they can continue without giving up when they face difficulties can be supported. Psychoacademic studies that are thought to increase grit, academic self-efficacy, and motivation levels can be done for that purpose.

Results of the research showed that studies could be designed for the researchers that deal with the mediating and moderating effects of variables such as psychological resilience, hope, optimism, academic well-being, academic strength, and academic procrastination, which are thought to affect academic stress levels of students in future studies. Since this study was carried out only on preclinical medical students, comparative research can be conducted on students in different departments or with students studying in various provinces in future studies. This research was designed as cross-sectional. Longitudinal studies can be completed in future studies.

**Limitations**

This research has some limitations such as its sampling method and data collection methods. This research was designed in a cross-sectional design and convenient sampling method was used to determine the sample. In the collection of data, online method was used due to the online education in time of COVID-19. In this context, there are some limitations in generalizing the data originating from the method and sample to the population. Although these limitations are tried to be eliminated by including participants with various characteristics as much as possible, generalization limitations can be eliminated by designing probabilistic sampling method and longitudinal studies in future studies. This research was conducted with students studying at three different faculties. In order to increase the generalizability of the results obtained in future studies, it can be examined whether the same model is confirmed in different departments by including different faculties and using a multi-group structural equation model.

Since this research is limited to students’ responses to the scales and uses the quantitative method, variables that cause academic stress can be investigated by using qualitative and mixed methods in future studies. In this study, the mediating effect of grit and academic self-efficacy on the relationship between psychological need satisfaction and academic stress was examined. In this context, academic stress has been tried to be explained only by non-cognitive variables. Its relationship with other variables such
as intrinsic motivation, flow experiences, cognitive flexibility, and problem-solving skills that may affect academic stress can be discussed. Experimental research can be designed to reduce academic stress with taking into account grit, academic self-efficacy, and psychological need satisfaction. In this study, it is not known how many categories the stress levels of the students in the sample group are clustered. At the same time, it does not contain information about the stress levels of students at different grade levels. In future research, the change in students’ stress in different years can be determined by latent profile analysis and the number of groups can be determined, and the change over the years can be evaluated with longitudinal studies.

Declarations

Conflict of interest  The authors declare no competing interests.

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Current themes of research:

Knowledge Levels of Turkish Medical Students on COVID-19 and Early Psychological Reactions to the Pandemic: Depression, Anxiety, Stress and Associated Factors.
Being a Medical Student in the Shadow of the Pandemic Psychological Effects of the COVID-19 Pandemic on Medical Students and Students’ Views on Distance Education.
Burnout Levels of Medical Students in COVID-19 Pandemic: A Cross-Sectional Study.

Most relevant publications:

Self-efficacy perceptions of Atatürk University term 6 students about neurological emergencies: A pilot study Neurological emergencies in the perspective of the national core education program of medical education.

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Current themes of research:

Investigation of the Relationship between Pre-service Teachers’ Self-Efficacy and their Attitudes towards the Education of the Disabled.
Investigation of Emotional Autonomy of Adolescents According to Various Variables.
Examining the Relationships Between Autonomy, Attachment Styles, Mindfulness, and Emotion Regulation.

Most relevant publications:

The mediator role of academic self-efficacy academic motivation and flow experiences between psychological need satisfaction with well-being.

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