

# Investigating the Correlations between Problem Solving Ability, Resilience and Academic Burnout of Virtual Medical Education Students Using Structural Equation Modeling

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The purpose of the present study is to investigate the correlations between academic resilience and academic burnout analyzing the problem-solving ability of the students. In 2021 the research questionnaires (demographics, academic burnout, academic resilience and problem-solving ability) were sent online through Press Online software, 260 students of virtual medical education were recruited for this study. Descriptive statistics, Pearson correlation and Structural equation modeling were used to examine the characteristics of the participants, correlation between main variables in order to test the study hypothesis. Based on the results, we found out that the model fit indices, CFI (comparative fit index), NFI (normed fit index), TLI (Tuckere Lewis index), X2/DF (the ratio of X2 to degrees of freedom) and RMSEA (Root mean of square error approximation) were appropriate. We discovered, that the academic burnout with problem solving skill ( $\beta = -0.77$ ), academic resilience ( $\beta = 0.26$ ) and problem-solving skill with academic resilience ( $\beta = 0.96$ ) has a statistically significant correlation. Also, it was found that most of the correlations between academic burnout and academic resilience are indirect, we get them through the mediator variable of problem-solving skills (-0.871). The results of this research determined that there is a certain group of students at risk, who are suffering from burnout and weak problem-solving skills, who are at risk. Such students should be identified and provided with short courses for the developing of adaptive coping skills, such as problem solving, in order to prevent their academic burnout.

**Keywords:** academic burnout, academic tolerance, problem solving ability, structural equation modeling, students.

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## Исследование взаимосвязи между способностью к решению проблем, устойчивостью и академическим выгоранием у студентов, получающих виртуальное медицинское образование с использованием моделирования структурными уравнениями

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Цель настоящего исследования заключается в изучении взаимосвязи между академической устойчивостью, академическим выгоранием и способностью решать проблемы у студентов виртуального медицинского образования. В рамках исследования были использованы анкеты, включающие демографические данные, а также данные по академическому выгоранию, академической устойчивости и способности решать проблемы. Анкеты были разосланы онлайн с использованием программного обеспечения

Press Online в 2021 году. В исследовании были применены описательная статистика, корреляционный анализ Пирсона и моделирование структурными уравнениями для изучения характеристик участников и проверки гипотез исследования. По результатам исследования были определены индексы соответствия модели CFI (индекс сравнительного соответствия), NFI (индекс нормированного соответствия), TLI (индекс Такера-Льюиса), X2/DF (отношение X2 к степеням свободы) и RMSEA (среднеквадратичное значение ошибки). Все эти индексы указывают на подходящее соответствие модели. Было обнаружено, что академическое выгорание имеет статистически значимую связь с навыком решения проблем ( $\beta=-0,77$ ), академической устойчивостью ( $\beta=0,26$ ) и навыком решения проблем с академической устойчивостью ( $\beta=0,96$ ). Также было установлено, что основная часть связи между академическим выгоранием и академической устойчивостью происходит косвенно через медиаторную переменную навыков решения проблем ( $-0,871$ ). По результатам данного исследования было выявлено, что существует группа студентов, которые испытывают академическое выгорание и имеют недостаточные навыки решения проблем. Эта группа находится в зоне риска. Рекомендуется выявлять таких учащихся и предлагать им специальные краткие курсы, направленные на развитие адаптивных навыков преодоления трудностей, включая решение проблем. Эти курсы помогут предотвратить академическое выгорание у студентов и будут способствовать их общему успеху в образовании.

**Ключевые слова:** академическое выгорание; академическая толерантность; способность решать проблемы; моделирование структурными уравнениями, студенты.

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## Introduction:

Although attending university is often linked with positive experiences, for some individuals it might result in indifference, exhaustion, and inefficiency (1). Academic burnout manifests as ineffectiveness, exhaustion, and apathy. Academic burnout is characterized by a lack of enthusiasm for learning, a negative outlook, and a sense of academic inadequacy (2). Academic burnout is the primary result of long-term stress, which is brought on by the excessive amount of homework and disregard for psychological fac-

tors. It decreases a person's capacity to cope with stressful situations while in school, which negatively affects cognitive commitment, interest in the course material, participation in class activities, and the sense of being able to learn the material and makes students feel incompetent and helpless. It therefore results in their poor performance. According to studies, in addition to making individuals less equipped for the workforce and increasing absenteeism and the desire to quit the service, studying also reduces people's motivation to work (5). Resilience is

one of the things that may protect individuals from stressful conditions and keep them from experiencing depression (6—7). The capacity to bounce back from ongoing problems and be able to rebuild oneself is resilience. Despite being subjected to intense stresses, this human potential may help him overcome unpleasant situations, and he can also increase his social, intellectual, and professional competence which reduces academic fatigue (8—9). A construct called resilience has elements related to learning, behavior, and emotion. Academically resilient students are those that remain highly motivated to succeed and perform at their best in spite of adverse environmental circumstances that may otherwise lead to poor academic performance or even dropping out (9). The capacity to address issues is another important factor in academic burnout. The term "problem solving skill" refers to a cognitive-behavioral process that offers a variety of potential and alternative solutions to deal with problematic situations. This process increases the likelihood of selecting the best and most efficient alternative solutions and effectively dealing with current and potential future problems (10). In many ways, developing problem-solving skills may be considered as a process of fostering personal development and, as a consequence, raising the likelihood of successful coping in a variety of circumstances. People find, develop, or uncover resources for successfully dealing with traumatic life situations throughout this phase (11). Oral et al. (2006) discovered that a person's health and successful development depend greatly on their capacity to confront difficulties and use problem-solving techniques. They point out that via problem-solving, individuals learn to cope with difficulties rather than avoid them, utilize the resources they already have, and think creatively, all of which help to build resilience (12). Depression is a problem that is particularly prevalent among students, because they experience a lot of stress throughout their education. Students experience a lot of stress due to a variety of factors, such as a relocation and an abrupt separation from their families, unfamiliarity with the university setting and culture, a lack of interest in their field of study, interpersonal difficulties,

academic pressure, exam anxiety, and a lack of financial and welfare resources (13). Additionally, online education due to the COVID-19 pandemic may also have an impact on the students' academic performance. Some courses involve practical and laboratory workshops, and there are many courses to choose from, students don't have enough mobility and they must spend hours learning online. Many researchers examined an academic burnout using straightforward statistical correlations, they found, that the modeling facilitates a better and more precise understanding of interactions between various factors. The current study's objective is to use structural equation modeling to ascertain the association between students enrolled in virtual medical education and their capacity for problem solving, resilience, and their risks of academic burnout.

Hypotheses and research questions

- 1) Is there a correlation between academic burnout and problem solving ability?
- 2) Is there a correlation between problem solving ability and academic resilience?
- 3) What is the correlation between academic burnout and academic resilience?

### **Methods:**

The present research is cross-sectional and descriptive. All master's students at Tehran's Shahid Beheshti University who participate in online education were recruited for the statistical analysis. Based on the research conducted by McCallum in 1999 (14), the sample size was estimated using the ratio of the sample size to the free parameter. According to it, the lower limit is five to one, the average is ten to one, and the maximum is twenty to one. The sample size for this research was determined to be 300; of the total number of issued questionnaires, 260 were fully completed and returned, and these were the questionnaires that were examined in this study.

### **The tool used:**

Demographic Information Questionnaire: online questionnaire included demographic variables, such as age, sex, occupation and marital status, year and academic term.

Academic Resilience Questionnaire: Samuels created the academic resilience question-

naire in 2004. (15). The participants are asked to score their degree of academic resilience on a 5-point Likert scale, from strongly disagree (1) to strongly agree (3), in 41 items that make up the final form of this questionnaire (5). There are three parts to this scale. These elements include problem-solving abilities, an optimistic outlook, and communication skills. In 2012, Soltaninejad et al. standardized the current questionnaire in Iran (16). They found Cronbach's alpha coefficients in the student sample ranging from 0.62 to 0.76.

#### **Academic burnout questionnaire:**

The modified general version of the Maslach burnout scale was used to assess academic burnout (17). In 2002, Schaufli and colleagues modified it (18). There are three subscales and a total of 15 items on the survey. Five questions are used to assess emotional exhaustion, four to assess doubt and pessimism, and six to assess intellectual self-efficacy. Every question is graded on a 7-point scale, with 0 being never and 7 being always (6). Academic burnout is indicated by high emotional tiredness, uncertainty, pessimism and low self-efficacy scores. For the female students of Isfahan University in 2013, Zainab Rostami conducted the standardization of this scale. The emotional exhaustion subscale had a Cronbach's alpha of 0.89, uncertainty had a 0.84, and self-efficacy had a 0.67. (19).

#### **Problem solving ability questionnaire:**

To measure problem solving ability, we use Hepner's problem solving skill survey, which was developed in 1988 (20). This survey asks 35 questions on a Likert scale with 6 levels, from fully agree (1) to completely disagree (6). 15 statements with negative connotations are presented and graded backwards to guard against fraud. The questionnaire's overall score is calculated by adding the scores of each response. 11 statements address problem-solving confidence; 16 statements address tendency-avoidance style; and 5 comments address personal control. Rastgo et al study in 2011 determined the reliability of this questionnaire, and the alpha coefficient for self-confidence in problem solving was 0.80, for welcoming or avoiding

issue solving activities it was 0.78, and for managing emotions and behavior it was 0.70. (21).

#### **Variables' normality test:**

Kolmogorov-Smirnov test is used to examine and confirm the normality of the sample distribution and the data. The null hypothesis is rejected in this test if the P-Value decision threshold is less than 0.05, which suggests that the data cannot come from a certain distribution like the normal, Poisson, exponential, or uniform. All factors seem to be normal based on the findings, which are shown in Table 1.

#### **Correlation test:**

The next stage is to confirm that there is a meaningful link between the variables in order to verify the study hypotheses using the structural equation modeling approach, which is based on regression analysis. The Pearson correlation analysis will be applied since each variable is normally distributed. Table 2 lists the findings of the connection. If the correlation coefficient between two variables is less than 0.25, the correlation is deemed weak; if it is between 0.25 and 0.6, the correlation is deemed average; and if it is more than 0.6, the correlation is deemed strong. It implies that the two variables have a significant link.

#### **Sample size adequacy test:**

KMO (Kaiser-Meyer-Olkin) criterion shows whether a data set is enough for factor analysis. Kaiser-Mayer-Olkin index, KMO: this index must be above 0.7, although between 0.5 and 0.7 it is also acceptable with caution. Furthermore, Bartlett's test is to show the ability of the variables to act, and for this purpose, this test must be meaningful.

#### **Fit of measurement and structural models:**

The adequate fit of both measurement types and structural models is important to consider when using modeling structural equations. The components of the overall model that depict the link between manifest and latent variables are known as measurement models. Six measurement models for the first and second order hidden variables based on the conceptual frame-

work of this study are reflective, i.e., the obvious variables or survey questions explain the properties of the model's hidden variables. First, factor loadings and significant t-numbers for all obvious variables must be determined in order to start evaluating the fit of measurement models. There is no need to remove any of the obvious indicators or variables describing the measurement models because the coefficients of the factor loadings for all indicators are greater than 0.4, the significant numbers are greater than 1.96, and the relationship between the structure and the indicators is significant.

To assess the fit of the model, several indices were applied, including CFI and RMSEA.

The greater the comparative fit index (CFI), which ranges from zero to one, the better the model fits the data. RMSEA statistic, also known as the root mean square error of approximation statistic, may be used to measure how well a model fits the data. Another measure is the chi square to measure a degree of freedom ratio, or  $\chi^2/df-1$ ; if this ratio is less than 2, the model considered well-fitted; if it is more than 2, the model considered acceptable. Table 1 lists further useful indicators. Based on the Table's data, all of the acquired indicators are at a level that is acceptable, and the measurement and structural models fit together well (22—23).

## Results:

260 students were evaluated using study scales for the current research. Of them, 247 questionnaires were examined, and 13 questionnaires were eliminated for lack of data. The participants' ages, which ranged from 35 to 49, were on average 40. Among them, 98.8% were married, 2% were single, and 71.1% of the participants were women. 23.07% of the respondents were in their second semester, with the remaining respondents being in their third semester or later. Additionally, 100% of the population was working, and those who did work, worked as nurses, midwives, doctors, public health workers, and laboratory scientists, respectively.

The link between the first and second was examined using Pearson's correlation coefficient, and the results are shown in the table. The results of the correlation study demonstrate a substantial correlation between the research variables, and it can be said that all of the research variables have a significant relationship with one another at a confidence level of 0.99%. Additionally, it was determined that none of the variables' significance levels are above the error level of 0.01, allowing the correlation between the variables to be accepted.

Table 1

### The results of descriptive statistics and indicators of reliability, normality of variables and adequacy of sample size

KMO test	BT test	Kolmogorov-Smirnov test	Cronbach's alpha	Mean and standard deviation	Variables
0.85	0.001	0.26	0.7	26.3 (5.6)	Academic self-efficacy
			0.7	7.5 (1.5)	Emotional exhaustion
			0.7	23.9 (5.3)	Doubt and pessimism
			0.85	57.8 (11.2)	Academic Burnout
0.77	0.001	0.14	0.7	41.3 (8.8)	Confidence to solve problems
			0.9	64.4 (14.2)	Tendency-avoidance style
			0.6	18.5 (4.4)	Personal control
			0.93	124.3 (24.9)	Hepner's Problem solving
0.91	0.001	0.48	0.8	48.7 (8.6)	Future orientation
			0.8	37.5 (6.8)	Communication skills
			0.7	23.4 (4.4)	Problem-oriented and positivity
			0.92	109.7 (18.6)	Academic resilience

$\chi^2/DF$  and RMSEA statistics have numbers below 3 and 0.08 respectively, what indicates the good fit of the model. Due to the results of the modeling among the variables of academic

burnout, academic resilience and Hepner's problem solving ability, it was found that the variable of academic burnout with problem solving skills ( $\beta = -0.77$ ,  $p = 0.00$ ), academic resili-

Table 2

Correlation coefficients between research variables

No		1	2	3	4	5	6	7	8	9	10	11	12
1	Emotional exhaustion	*											
2	Doubt and pessimism	.725**	*										
3	Academic self-efficacy	.612**	.564**	*									
4	Confidence to solve problems	-.625**	-.610**	-.432**	*								
5	Tendency-avoidance style	-.447**	-.426**	-.302**	.712**	*							
6	Personal control	-.511**	-.484**	-.339**	.741**	.670**	*						
7	Communication skills	-.456**	-.419**	-.295**	.672**	.764**	.625**	*					
8	Future orientation	-.495**	-.472**	-.373**	.681**	.739**	.621**	.821**	*				
9	Problem-oriented and positivity	-.391**	-.362**	-.279**	.598**	.671**	.579**	.830**	.749**	*			
10	Hepner's Problem solving	-.568**	-.546**	-.386**	.893**	.942**	.822**	.785**	.773**	.698**	*		
11	Academic burnout	.930**	.916**	.715**	-.663**	-.468**	-.533**	-.468**	-.524**	-.406**	-.597**	*	
12	Academic resilience	-.487**	-.454**	-.340**	.704**	.785**	.656**	.962**	.926**	.898**	.814**	-.506**	*

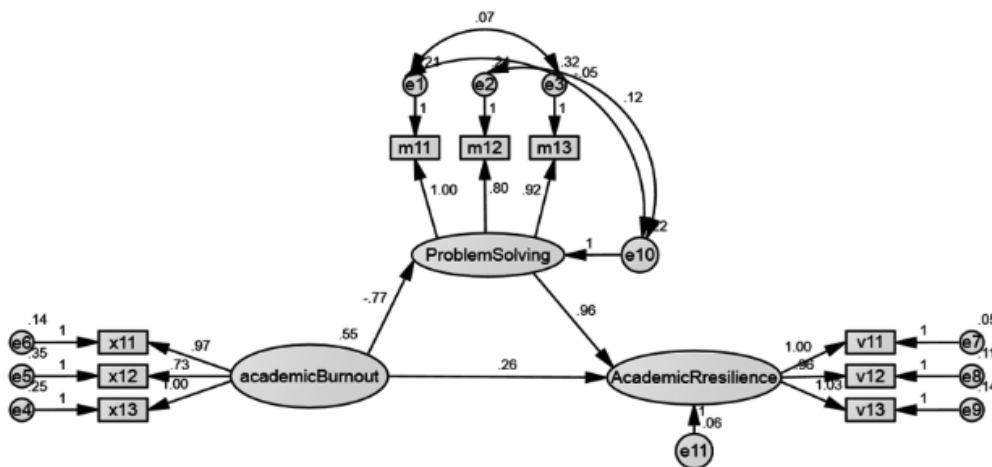


Figure 1- The final research model



Table 3

**Model fit indices**

Structural model	Recommended value	Fit indices
43.25		$\chi^2$
2.06	1—3	the ratio of $\chi^2$ to degrees of freedom ( $\chi^2/df$ )
0.992	$\geq 0.90$	comparative fit index (CFI)
0.984	$\geq 0.90$	normed fit index (NFI)
0.986	$\geq 0.90$	Tuckere Lewis index (TLI)
0.052	$< 0.08$	Root mean of square error approximation (RMSEA)

ience ( $\beta = 0.26, p = 0.00$ ) and problem solving skills and resilience statistically are pretty much related ( $\beta = 0.96, p = 0.00$ ). Moreover, based on the results of mediating variable analysis, it was found that most of the correlations between academic burnout and academic resilience are indirect and via the mediating variable of problem solving skills ( $-0.871$ ).

**Discussion:**

The goal of the current research was to examine the correlation between academic resilience, academic burnout and problem-solving skills among students enrolled in online medical education. via the mediation of problem-solving skills. It has an excellent fit based on the results of structural equation modeling, and the model's fit indices support it. We used positive fit indicators GFI 0.93, RMSEA 0.07, and other indicators, which were above 0.9. Bahrami et al. (2016) revealed that the model of the influence of perception of the classroom environment through academic resilience on academic burnout has a suitable value, which supports the results of the proposed model (1). The findings of the current study are compatible with the research of Abol-Maali et al., which also has strong fit indices of RMSEA 0.055 and GFI 0.94. (24). Arabian et al.demonstrates the proper fit indices of the research model, and the RMSEA indices 0.069, GFI 0.95, suggesting the direct influence of problem-solving ability and its indirect effect through the mediation of resilience on lowering academic burnout. (25). According to the current findings, academic resilience and academic burnout have a substantial and inverse correlation. The research by Bahrami et al. (2015) discovered a substantial connection

between resilience factors and academic burnout (1). Academic stresses have an impact on the factors of academic burnout, academic motivation, and academic resilience, according to a research by Yazdakhasi and Fazel (2015). They discovered that individuals with strong resilience preserve their psychological flexibility in challenging and bad circumstances, and as a result their productivity and job satisfaction grow(26). Hope, resilience, and emotional intelligence are negative predictors of academic burnout, according to research by Sadouqi et al. (27). The study of Viskarmi and Gashnigani (2017) concluded that academic resilience and cognitive adjustment strategies play a significant role in decreasing academic burnout (28). A study by Syprine Aoko Oyoo et al., a study by Liselotte N Dyrbye et al., and a study by Garcia-Izquierdo M et al. also found similar results (29—31). Thus, it can be concluded that enhancing the level of resilience as well as training students and long-term planning to increase resilience will play a decisive role in decreasing academic burnout. In fact, those who are resilient can handle and even excel in challenging circumstances in life, and this quality helps them adjust to stressful events, increasing productivity and reducing academic burnout. Students that show more resilience are more efficient and feel more capable to overcome obstacles in their lives. Students who are more resilient are able to see problems as problems and feel less alone and forlorn. They search for alternative solutions or methods to change the situation . Since optimism is one of the traits of resilient people, it helps these students, despite being in high-risk and traumatic environments, to not be mentally damaged and to look at problems in learning and problems in



life in a positive and optimistic way. This gives them a positive outlook and optimism towards life. Consequently, these individuals experience less academic burnout, show higher flexibility in challenging circumstances, and feel more productive and satisfied at work.

According to the results, problem-solving abilities and academic resilience are directly related in a substantial way. There was a positive and substantial linear connection that demonstrated the correlation and prediction of resilience and coping mechanisms in the research by Jess de la Fuente et al. published in 2017. These elements had a big positive impact on the university students' academic performance. (32). The results of a study by Coşkun et al. demonstrate that college students are quite flexible. Additionally, there were no discernible differences in university students' resilience levels according to their gender, grade level, monthly income, or housing options. But when it comes to a talent, job experience, academic success, potential professional growth, father's educational level, parenting style, and self-description, the results vary significantly in terms of resilience. Additionally, according to the average problem-solving score, university students have average problem-solving abilities. However, the Pearson correlation coefficient of 0.67 ( $p > 0.05$ ), calculated to see the correlation between students' resilience and problem-solving abilities, revealed a favorable and somewhat strong connection between university students' resilience level and their problem-solving abilities (33). We could suggest that making effective use of students' social standing enhances their flexibility and resilience in social interactions.

According to our results, academic problem solving abilities and academic exhaustion are inversely related. According to a Shin and Hwang research, academic resilience is an important characteristic. Students who possess it are more likely to pursue their education and gain from initiatives that improve their social

skills (35—34). The research of Arabian and colleagues, which is congruent with the current study, demonstrates the direct relationship between problem-solving skills and resilience (25). In Abol-Maali et al study likewise produced comparable outcomes (24). It should be taken into account that students who are better at solving problems perform better and with higher quality, are more productive, and are more motivated. This is true even when a cause of environmental stress is minimal and manageable. It can even make people happy and prevent problems. When a person believes that his professors and classmates are rooting for him and that he has an identity, he feels content and happy. This issue may also be brought on by the fact that a positive work environment boosts motivation and workers' performance. When high-level employees have a collaborative work environment, they will build more engaging relationships with one another. People who are experts at solving problems tend to cooperate well, act with motivation and interest, and project a positive image in the university setting. As a consequence, psychological pressure and burnout are reduced in this setting.

The correlation between academic resilience, academic burnout and problem-solving skills is effectively explained by the current study's theoretical model. Having effective problem-solving, resilience, and adaptability skills is one of the benefits. Social support, which reduces the student's emotional exhaustion and prevents him from feeling worried, is closely connected to his resilience and adaptability. Students also possess problem-solving skills and a sense of responsibility, which are related to competence, self-control, a desire to grow, and improvement. As a result, the student's consistency in responsibility and consciousness enable him to carry out his responsibilities well while he studies and finishes his job. He is also more likely to be engaged in his work, which reduces the possibility of burnout.

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