

# A Study of Factors Predicting Students' University Academic Achievement

A. Amarzaya<sup>1\*</sup>, J. Ankhbayar<sup>2</sup>, M. Narantuya<sup>3</sup>

<sup>1</sup>National University of Mongolia, School of Arts and Sciences, Department of Mathematics.

<sup>2</sup>Mongolian University of Life Sciences, School of Applied Sciences, Department of Physics and Mathematics.

<sup>3</sup>National University of Mongolia, School of Arts and Sciences, Department of Education.

\*Corresponding author: A. Amarzaya, Department of Mathematics, National University of Mongolia. Email(s): amarzaya@smcs.num.edu.mn (AA); ankhbayar@mul.s.edu.mn (JA); mend.narantuya@yahoo.com (MN)

**Citation:** Amarzaya A, Ankhbayar J, Narantuya M (2024) A Study of Factors Predicting Students' University Academic Achievement. American J Sci Edu Re: AJSER-187.

**Received Date:** April 25, 2024; **Accepted Date:** May 03, 2024; **Published Date:** May 08, 2024

## Abstract

The purpose of this research is to determine a relation between the academic achievements of Mongolian university students and a score on admission tests and high school achievement. To achieve our goal, we considered the correlation between student's undergraduate grade point average (UGPA) and score of the university admission tests (AT). We also take into account the average grade point of the student in the first year. In other words, the extent to which the AT score, the average certificate score, and the GPA of the first year affect the student's success at the university was studied. By this we are studying the validity of our country's AT scores. The research was carried out based on data from students from National University of Mongolia (NUM), Mongolian University of Life Sciences (MULS), University of Finance and Economics (UFE) and Mongolian State University of Education (MSUE) who graduated between 2018-2022. The sample included 4,207 NUM graduates, 3,015 MULS graduates, 853 UFE graduates, and 5,288 MSUE graduates, a total of 13363 graduates.

The analysis was performed using regression analysis. For a total of eight semesters of university study, the GPA of the first four semesters of graduates is statistically weakly dependent on the AT score, while the average AT score of the last four semesters is approximately twice as weak. Furthermore, the correlation between the UGPA of the graduates and the AT score is seen to decrease from the first year to the fourth year.

The UGPA of the graduates was statistically weakly related to the AT score. It also looked at how graduates' UGPAs were affected by their average certificate score. A model was studied that correlated graduate UGPA with average certificate score, AT score, first year GPA, and moderator variables.

**Keywords:** Predictors, UGPA, coefficient of determination, regression equation.

## 1. Introduction

The aim of this research is part of the larger ambiguous purpose of investigating the relationship between the results of an assessment of any level of education and academic achievement and performance at the next level, based on mathematical statistics. The one of the purposes of educational tests is to determine the level of achievement at a certain level of education and is limited within that level. But learning occurs continuously. However, knowledge and skills acquired at a certain level are directly related to the quality of previous education. In this regard, there are many theories and models to explain the process in the whole. An Astin's (1985) "Input-Environment-Outcome" model and V. Tinto's (1993) "Student Dropout Concept" are examples of them. Astin considers the quality of secondary education of university entrants as an input, while as an outcomes he considers the complex competences that include social skills as well as the technical skills of the specialist. V. Tinto states that Student Academic Achievement refers to a student's mastery of learning styles or previous educational outcomes.

University admission tests focus on selecting people who are relatively independent, creative, and relatively ready to participate in higher-level training that requires a certain degree of personal courage toward higher education. This means that the higher education institution not only provides training, but also acquires the skills of the researcher required to

independently perform research and analysis; on the other hand, it requires higher-order mental activities such as the training methodology of training specialists in the field of branch sciences, skilful use of previous knowledge, creative imagination, critical thinking, and reflection.

Scholars have noted that among the many factors that ensure the quality of education in higher education institutions, the basic knowledge of secondary school graduates occupies a special role (Astin). On the other hand, the problem of the quality of university graduates is one of the pressing problems of employers. One of the reasons for conducting this research is the selection of university applicants and the quality of the applicants.

Here we briefly introduce the higher education (HE) system of Mongolia. The country's higher education system consists of two players, State and private HE institutions. There are only five state HE institutions that enroll more than 60% of students, while there were 71 private HE institutions operating in the country.

High school graduates who want to enroll in HE institutions have to pass a general admission examination (we call it an admission test), where Mongolian language examination is mandatory and select one or more subject specific examinations depending on requirements of the HE institution they want to enroll in.

For the case of Mongolia, the admission test is a very responsible step for students to determine the direction of a person's future life, not an ordinary exam for semester or grade promotion. Depending on which subject the graduates took the AT, they will further determine their future life by acquiring a profession based on those subjects. Therefore, it is very important to conduct research on how AT results are related to the academic success of graduating students.

The main goal of this research is to determine a relationship between academic achievement of Mongolian university students and a score on admission tests and high school achievement. To achieve our goal, we considered the correlation between student UGPA, score of their university admission tests, and student's grade point average of the first year.

To achieve our research goal, we set the following research objectives. The UGPA of university graduates will be compared with the AT score, the average score of the certificate, and the GPA of the first year, and a statistical analysis of the relationship between them will be made and a simple mathematical model will be made that can predict the UGPA of university graduates.

The research was carried out on the data of 13'363 students of the National University of Mongolia (NUM), Mongolian University of Life Sciences (MULS), University of Finance and Economics (UFE) and Mongolian State University of Education (MSUE) who graduated between 2018 and 2022. The University of Finance and Economics is one of the main private universities of the country and the others are three of the five state universities.

The analysis was performed using regression analysis. For a total of eight semesters of university study, the GPA of the first four semesters of graduates is statistically weakly dependent on the AT score, while the average AT score of the last four semesters is approximately twice as weak. Furthermore, the correlation between the UGPA of the graduates and the AT score is seen to decrease from the first year to the fourth year.

The UGPA of the graduates was statistically weakly related to the AT score. It also looked at how the graduates' UGPAs were affected by their average certificate score. A model was studied that correlated graduate UGPA with average certificate score, AT score, first year GPA, and moderator variables.

## 2. Review of the literature

To carry out this research, we examined research related to admission tests used in other countries. Many researchers studied impacts of the results of the internationally recognised SAT and GRE test with the academic achievements of a student in the university study. In such studies, the concept of predictive validity is studied. Some of those studies will be mentioned below.

In 1998, Boven and Bock [3] showed how a college student's SAT scores can be ranked in the class using unstandardised weights (i.e. regression coefficients). The sum of the verbal and maths scores of the SAT was scaled to 100-point intervals. The unstandardised weight for the SAT scores in their estimated regression equation was 5.93. In this study, regression analysis showed a positive correlation only between students' SAT scores and academic ranking in the classroom. Although this relationship was statistically significant, the effect size was weak.

In 2003, Bridgeman, Pollack, and Burton [4] studied the possibility that SAT test scores predict academic success at the undergraduate level. They included 41 schools and divided them into 4 groups based on their average SAT test scores. Furthermore, the students were divided into 2 groups according to their GPA: higher than 3.5 and between 2.5 and 3.5. The grade-point average was measured at the end of the second year and at the end of the fourth year. Three predictors were used to predict the proportion of students at each grade level: high school grades, high school curriculum intensity, and SAT scores. It was concluded that these 3 factors do not have a strong influence on academic success.

In 2001, Kunsel, Hezzlett, and Vanes [1] conducted a meta-analysis of studies on the validity of the GRE test. They selected a representative sample of 1,753 out of 85,000 graduate students to determine achievement in graduate schools. In doing so, they used eight criteria.

In 2005, Burton and Wang [2] reported on the relationship between GRE scores and academic performance of students in 21 graduate school departments. The research was carried out using simple correlation and multiple correlation analysis. The correlation between GRE test scores and grades in the first year of graduate study was found to be  $R=0.3$ . The coefficient of variation was found to be 9%. The effect of GRE test scores on predicting first-year grades was relatively weak.

The 2008 study by Bridgman, Burton, and Silin [5] was the most important research work. They used a large set of grade data for their analysis. Their data consists of two parts, where the primary data included 3,303 students from 128 graduate school departments who participated in the validity study of the GRE test between 1987 and 1991. The graduate school departments were Biology, Chemistry, Education, English, Experimental Psychology, and Clinical Psychology. The second data consisted of data from a 2005 study by Burton and Wang [2]. A total of 1,148 master's and doctoral students enrolled in graduate school in 1995–1996, 1996–1997, and 1997–1998 were included. These students were students from 17 departments, including biology, chemistry, education, English, and psychology. Advanced academic achievement was analysed using three factors: undergraduate GPA and GRE verbal and quantitative reasoning test scores. The analytical writing test score, which is the third part of the GRE test, has also been concluded that it can be further improved by adding it to the research [5].

In 2018, Jonny Wolperhorst, Christel Lutz, Renske de Kleijin, and Jean Van Tartwyk [6] investigated the predictive validity of high school grades to university academic achievement. Their sample consisted of 113 high school IB (International Baccalaureate) graduates and 314 Dutch high school graduates. In the research, the objective is to predict academic success in the first and fourth years of university based on the results of three high school subjects. Furthermore, the relationship between the fourth-year GPA and the first-year GPA was studied. In doing so, the t-test and multiple correlation analysis were used. For Dutch universities, the GPA in the three main subjects was more relevant to the GPAs of the first year and the graduation of students than to their GPAs at high school. On the other hand, for graduates who studied in the international Baccalaureate programme, two factors had a significant effect on GPA: the GPA of the first year of the student and the GPA of the high school.

We also reviewed research of Mongolian scholars in this direction of study. Most of the research was conducted in Mongolian, and we cite the most interesting one. In 2018, Ts. Luvsandorj, B. Shurentsetseg [7] completed a research on the topic of "quality analysis of student certificates, general entrance exams, and GPA". It was intended to answer whether there is any mutual influence and connection between these three variables and, if so, whether it can be expressed in numbers. In this study, a correlation analysis was performed between the average secondary school certificate, the AT score and the average bachelor's degree of 138 students who graduated from the School of Mathematics and Natural Sciences of MSUE as a mathematics teacher in 2016 and 2017. The correlation between the UGPA of a graduate's bachelor's degree and his or her AT score and the average certificate score was concluded to be low.

**3. Research Methods and Research Results**

This research was carried out based on data from NUM, MULS, UFE and MSUE graduates. The sample included 4,207 NUM graduates, 3,015 graduates of five MULS constituent schools, 853 UFE graduates, and 5,288 MSUE graduates, or a total of 13,363 graduates.

The analysis was performed by finding the relationship between the variables, determining the form, evaluating this relationship, and evaluating the unknown value of the dependent or outcome variable.

In the study, the AT score and the average score of the certificate, the first-year GPA, the moderator variable (the

moderator variable is a variable created by the interaction of the factors under consideration) as a predictor variable or the UGPA of the graduate as the outcome variable. However, the outcome variables were changed in several ways and, when determining the relationship, regression analysis was performed separately for all graduates, for each department, for each semester, for each constituent school, and for the years of graduation. The SPSS29 and Excel 2019 softwares were used in the calculation.

When checking the distribution of the UGPA of the graduates and their AT score, according to the Kolmogorov-Smirnov test, the significance level of  $\text{sig}=0.000<0.05$  is not normal. The Kruskal-Wallis test was then used to answer whether the UGPA and AT scores of graduates are different depending on the universities and the year of graduation. Then, for universities, the UGPA of the graduates was  $\chi^2=419.306, p=0.000<0.05$  or statistically significant and different, and the AT score was  $\chi^2=2964.624, p=0.000<0.05$  or statistically significant and different.

Furthermore, the UGPA of the graduates was  $\chi^2=564.684, p=0.000<0.05$  for each year, while the score of AT was  $\chi^2=1271.783, p=0.000<0.05$  for each year, which was statistically significant and different. In other words, the UGPA of the graduates and their AT score differed by university and year of graduation. Based on the results of Kruskal Wallis, the following regression model was calculated in the study and the statistical significance was assessed.

**Table 1.** Models to Consider.

Model	Universities	Outcome variable	Predictor variable	Sample
<b>Model 1</b>				
Model 1a	NUM	the UGPA of the graduates	AT score	4207
	MULS	the UGPA of the graduates	AT score	3015
	UFE	the UGPA of the graduates	AT score	853
	MSUE	the UGPA of the graduates	AT score	5288
	MULS+NUM+UFE+MSUE	the UGPA of the graduates	AT score	13363
<b>Model 2</b>				
Model 2a	By each subdivision of the School of Arts and Sciences, NUM	the UGPA of the graduates	AT score	4207
	by each department for NUM	the UGPA of the graduates	AT score	4207
Model 2b	By each school for MULS	the UGPA of the graduates	AT score	3015
	By each school for MSUE	the UGPA of the graduates	AT score	5288
<b>Model 3</b>				
Model 3a	NUM	GPA of 1,2,3,4,5,6,7,8 Semester	AT score	2518
	NUM	First, second, third, and fourth GPA	AT score	4207
	UFE	First, second, third, and fourth GPA	AT score	853
	MSUE	First, second, third, and fourth GPA	AT score	5288
	NUM+UFE+MSUE	First, second, third, and fourth GPA	AT score	10348
Model 3b	NUM	the UGPA of the graduates	AT score, GPA of the 1st, 2nd semester	2518
	NUM	the UGPA of the graduates	The GPA of the first year and the AT score.	4207

	MSUE	the UGPA of the graduates	The GPA of the first year and the AT score.	1776
	UFE	the UGPA of the graduates	The GPA of the first year and the AT score.	853
	NUM+MSUE+UFE	the UGPA of the graduates	The GPA of the first year, and the AT score	6836
<b>Model 4</b>				
Model 4a	MULS	AT score	Average certificate score	2259
	MSUE	AT score	Average certificate score	5288
	MULS+MSUE	AT score	Average certificate score	7547
Model 4b	MULS	the UGPA of the graduates	Average certificate score	2259
	MSUE	the UGPA of the graduates	Average certificate score	5288
	MULS+MSUE	the UGPA of the graduates	Average certificate score	7547
Model 4c	MULS	the UGPA of the graduates	AT score, Average certificate score	2259
	MSUE	the UGPA of the graduates	AT score, Average certificate score	5288
	MULS+MSUE	the UGPA of the graduates	AT score, Average certificate score	7547
<b>Model 5</b>				
Model 5	for each year of graduation, MSUE	the UGPA of the graduates	AT score, average certificate score	5288
	for each year of graduation, MULS	the UGPA of the graduates	AT score, average certificate score	2259

### 3.1. Correlation between the UGPA of the graduates and their AT score

In this study, the correlation between the UGPA of all graduates who graduated from the 4 universities mentioned above in 2018-2022 (NUM), 2016-2018 (MULS), 2015-2021 (UFE), and

2019-2021 (MSUE) and their study of the AT score predicted the student's academic achievement based on the results of the AT score and derived a suitable regression equation. By graduate here we mean a university graduate. When considering the general statistics of graduates' UGPAs and their AT score:

**Table 2:** Descriptive statistics of the UGPA of the graduates and their AT score

Universities		N	Average	Median	Mode	Standard deviation	Variance	Skewness	Kurtosis	Range	Min	Max
NUM	UGPA	4207	3.005	3.1	3.1	0.45	0.205	-0.563	-0.165	2.5	1.5	4.0
	AT score	4207	631.83	633	607	54.53	2973.7	-0.2	0.789	382.4	417.6	800
MULS	UGPA	3015	2.84	2.83	2.75	0.46	0.217	0.142	-0.858	1.98	2.00	3.98
	AT score	3015	542.7	549	509	67.2	4518.9	-0.35	-0.197	493	236	729
UFE	UGPA	853	3.03	3.08	3.47	0.4	0.197	-0.385	-0.609	1.93	2.01	3.94
	AT score	853	637.2	642.5	636	58.8	3467.9	-0.619	0.666	364	436	800
MSUE	UGPA	5288	3.05	3.1	3	0.45	0.208	-0.244	-0.507	2.6	1.6	4.20
	AT score	5288	577.06	574	600	84.73	7179.4	0.178	-0.349	554	246	800
Total	UGPA	13363	2.99	3.019	3	0.46	0.215	-0.263	-0.579	2.65	1.5	4.15
	AT score	13363	590.4	598	607	79.24	6280.06	-0.217	-0.179	564	236	800

#### Description of the results:

Graduate AT scores ranged from 236 to 800, while UGPAs ranged from 1.5 to 4.

The average AT score of the graduates is 590.4, and their academic achievement is 2.99 UGPA.

After dividing the ordered distribution series of 13363 samples into 2 equal parts, the characteristic value corresponding to 50% of the distribution series, or the median, is 598 for the AT score and 3.019 for the UGPA. In other words, it shows that 50% of

all graduates who participated in the study have an AT score below 598, and the remaining 50% have an AT score above 598. The highest repetition of graduate AT scores was 607 points and the highest repetition of UGPA at graduation was 3. This means that there were the most graduates with 607 points in the AT and also that there were the most students who graduated with a UGPA of 3.

The AT score of the graduates varies from the average by 97.24 points, while the UGPA of the graduates varies from the average by 0.46 points.

The relationship between the UGPA of the graduates and their AT score was determined, and a simple model was developed to predict the UGPA of the graduates based on the AT score. Calculated by each university and together.

**Table 3:** Correlation between the UGPA of the graduates and their AT score.

Model 1a							
Universities	N	R	R <sup>2</sup>	ANOVA	Regression equation	b <sub>0</sub>	b <sub>1</sub>
				P		P	P
NUM	4207	0.299	0.09	0.000	Y=1.433+0.002x	0.000	0.000
MULS	3015	0.242	0.059	0.000	Y=1.931+0.002x	0.000	0.000
UFE	853	0.441	0.195	0.000	Y=0.912+0.003x	0.000	0.000
MSUE	5288	0.367	0.135	0.000	Y=1.917+0.002x	0.000	0.000
Total	13363	0.325	0.105	0.000	Y=1.87+0.002x	0.000	0.000

**Description of the results:**

The correlation between the UGPA of graduates and their AT score is 0.325, which is a weak and positive correlation. However, p=0.000<0.05 for each university, which means that it is statistically significant to analyze the relationships.

For all graduates, R<sup>2</sup> = 0.105, which means that 10.5% of the UGPA of the graduates is explained by the AT score. For example, 10.5% or 0.37 points in the grade of a graduate with a UGPA of 3.5 can be interpreted as the contribution of the AT score.

Analysis of variance showed that each regression equation that predicts the UGPA of the graduate with the AT score was statistically significant.

In all cases, coefficients b<sub>0</sub>, b<sub>1</sub> are influential.

As a general estimate, it can be assumed that increasing the AT score by 10 will increase the UGPA by 0.02. In addition, it will be possible to predict the UGPA based on the student's AT score. According to this model, for example, it can be assumed that an applicant with an AT score of 600 has an UGPA of 3.07.

**3.2. Correlation between the UGPA of the graduates and their AT score (for each branch, department, and constituent school)**

Each of the 4207 NUM graduates was considered by each branch and department, each of the 3015 MULS graduates, and each of the 5288 MSUE graduates were considered by each constituent school. In other words, the UGPAs of the graduates were calculated for each field, school, and department to predict their AT score.

**Table 4:** Correlation between the UGPA of the graduates and their AT score (for each branch, department).

Model 2a								
No	NUM	Number of students	R	R <sup>2</sup>	ANOVA	Regression equations	b <sub>0</sub>	b <sub>1</sub>
					P		P	P
Subdivisions of the School of Arts and Sciences, National University of Mongolia								
1	Natural Science	1271	0.348	0.121	0	Y=1.022+0.003x	0	0
2	Social Sciences	1433	0.182	0.033	0	Y=2.2+0.001x	0	0
3	Humanities	1503	0.251	0.063	0	Y=1.682+0.002x	0	0
Departments of the School of Arts and Sciences								
1	Chemistry	89	0.567	0.321	0	Y=1.231+0.006x	0.036	0
2	Physics	32	0.562	0.315	0	Y=0.383+0.005x	0.669	0
3	Mathematics	123	0.446	0.199	0	Y=0.373+0.004x	0.384	0
4	Biology	372	0.419	0.176	0	Y=0.575+0.004x	0.022	0
5	Geologists and geophysicists	123	0.417	0.174	0	Y=0.668+0.003x	0.109	0.001
6	Geography	532	0.36	0.13	0	Y=1.46+0.003x	0	0
7	Anthropologists, archeologists	53	0.325	0.106	0.017	Y=1.443+0.002x	0.018	0.017
8	European Studies	193	0.324	0.105	0	Y=1.306+0.003x	0	0
9	Education and Psychology	308	0.315	0.099	0	Y=2.066+0.002x	0	0
10	British and American Studies	309	0.287	0.082	0	Y=1.202+0.003x	0	0

11	Politics	164	0.281	0.079	0	$Y=1.902+0.002x$	0	0
12	Asian Studies	492	0.273	0.075	0	$Y=1.556+0.002x$	0	0
13	Journalism and Public Relations	221	0.27	0.073	0	$Y=1.915+0.002x$	0	0
14	Literature and art studies	88	0.257	0.066	0.015	$Y=1.635+0.002x$	0.004	0.015
15	Sociology and social work	259	0.25	0.063	0	$Y=1.948+0.002x$	0	0
16	Economy	428	0.22	0.049	0	$Y=1.712+0.002x$	0	0
17	Mongolian Language and Linguistics	214	0.207	0.043	0.002	$Y=1.998+0.002x$	0	0.002
18	History	147	0.176	0.031	0.033	$Y=2.433+0.001x$	0	0.033
19	Philosophy and Religion	60	0.08	0.006	0.546	$Y=2.371+0.001x$	0.002	0.546

**Table 5:** Correlation between the UGPA of the graduates and their AT score (for each school).

Model 2b								
№	Schools	N	R	R <sup>2</sup>	ANOVA	Regression equation	b <sub>0</sub>	b <sub>1</sub>
					P		P	P
<b>MSUE</b>								
1	School of Mathematics and Natural Sciences	1014	0.515	0.266	0	$Y=1.075+0.003x$	0	0
2	School of Humanities and Social Sciences	1753	0.416	0.173	0	$Y=1.689+0.002x$	0	0
3	Teacher's school	895	0.398	0.159	0	$Y=1.734+0.003x$	0	0
4	School of Educational Studies	469	0.387	0.15	0	$Y=1.766+0.002x$	0	0
5	School of Physical Education	318	0.374	0.14	0	$Y=1.546+0.003x$	0	0
6	School of Preschool Education	325	0.312	0.097	0	$Y=2.102+0.002x$	0	0
7	Arkhangai teacher's school	270	0.289	0.083	0	$Y=1.942+0.002x$	0	0
8	School of Fine Arts and Technology	244	0.265	0.07	0	$Y=2.47+0.001x$	0	0
<b>MULS</b>								
1	School of Veterinary Medicine	315	0.381	0.145	0	$Y=1.161+0.03x$	0	0
2	School of Animal Science and Biotechnology	549	0.358	0.128	0	$Y=1.491+0.003x$	0	0
3	School of Economics and Business	686	0.273	0.075	0	$Y=1.891+0.002x$	0	0
4	School of Engineering and Technology	486	0.225	0.05	0	$Y=1.573+0.002x$	0	0
5	School of Agroecology	979	0.17	0.029	0	$Y=2.247+0.001x$	0	0

### Description of the results:

Model 2a shows that the correlation between the UGPA of the graduates and their AT scores from the Natural Sciences subdivisions are higher than the scores of students from the other subdivision, showing a positive and moderate linear correlation. This was also proved by the correlation scores of students by departments, showing that correlation of scores of students from departments Chemistry, Physics, Mathematics, Biology, and Geology which all belong to the subdivision of Natural Sciences.

There are the same results for the case of MSUE. For the MSUE schools, the correlation between the UGPA of the graduates of the School of Mathematics and Science and the AT score is the highest, while that of the School of Fine Arts and Technology is the lowest.

When comparing the departments of the School of Arts and Sciences, the correlation between the UGPA of the graduates of the Departments of Mathematics, Physics, Chemistry, Biology, Geology and Geophysics and their AT score is higher than in other departments, and the Chemistry department is the highest, 0.567. For the Department of Chemistry, the coefficient of determination is 0.321, indicating that 32.1 percent of the variation in graduate UGPA is due to AT score. In other words, it means that the UGPA of the graduates is influenced by 32.1 percent of the AT score. For these departments of natural sciences, it appears that graduate AT score have a significant impact on academic success. This happens because students prepare for the AT by taking maths and natural science courses. If we look at the correlation between the UGPA of the graduates and their AT score for MULS, it is the highest (0.381) for the School of Veterinary Medicine, which shows a positive and

weak correlation. However, their study is statistically significant.

The analysis of variance showed that the common parameters of the regression analysis provided a good fit for each equation to represent the predictions. In other words, the values of *F* and *P* were found to be statistically significant.

**3.3. Correlation between the UGPA of the graduates and their AT score (for each academic year and semester)**

The GPA of each semester of the graduates was compared with their score, the correlation between them was determined, and the regression equation was derived. In other words, the GPA scores of the graduates were predicted for each year of their university course.

**Table 6:** Correlation between the UGPA of the graduates and their AT score (for each academic year and semester).

Model 3a							
Semester	N	R	R <sup>2</sup>	ANOVA	Regression equation	b <sub>0</sub>	b <sub>1</sub>
				P		P	P
NUM (for each semester)							
1	2518	0.263	0.069	0.000	Y=0.987+0.003x	0.000	0.000
2	2518	0.238	0.057	0.000	Y=1.241+0.003x	0.000	0.000
3	2518	0.244	0.060	0.000	Y=0.753+0.004x	0.000	0.000
4	2518	0.268	0.072	0.000	Y=0.790+0.003x	0.000	0.000
5	2518	0.2	0.04	0.000	Y=1.084+0.003x	0.000	0.000
6	2518	0.177	0.031	0.000	Y=1.604+0.002x	0.000	0.000
7	2518	0.147	0.022	0.000	Y=1.812+0.002x	0.000	0.000
8	2518	0.164	0.027	0.000	Y=1.658+0.002x	0.000	0.000
NUM (for each academic year)							
1	4207	0.288	0.083	0.000	Y=1.104+0.003x	0.000	0.000
2	4205	0.26	0.068	0.000	Y=1.132+0.003x	0.000	0.000
3	4202	0.212	0.045	0.000	Y=1.488+0.002x	0.000	0.000
4	4206	0.199	0.04	0.000	Y=1.745+0.002x	0.000	0.000
UFE (for each academic year)							
1	853	0.482	0.233	0.000	Y=-0.797+0.005x	0.000	0.000
2	853	0.314	0.116	0.000	Y=0.596+0.004x	0.009	0.000
3	853	0.292	0.085	0.000	Y=1.392+0.003x	0.000	0.000
4	853	0.361	0.130	0.000	Y=0.913+0.003x	0.000	0.000
MSUE (for each academic year)							
1	1776	0.329	0.108	0.000	Y=1.576+0.002x	0.000	0.000
2	5288	0.080	0.006	0.000	Y=1.127+0.001x	0.000	0.000
3	5288	0.241	0.058	0.000	Y=1.661+0.002x	0.000	0.000
4	5288	0.219	0.048	0.000	Y=1.925+0.002x	0.000	0.000
Total (for each academic year)							
1	6836	0.3	0.09	0.000	Y=1.355+0.002x	0.000	0.000
2	8550	0.294	0.086	0.000	Y=1.495+0.002x	0.000	0.000
3	10185	0.271	0.074	0.000	Y=1.755+0.002x	0.000	0.000
4	10223	0.243	0.059	0.000	Y=1.993+0.002x	0.000	0.000

**Description of the results:**

The correlation between the GPA of the first, second, third, and fourth semesters and the AT score is weak, while the correlation between the GPA of the fifth, sixth, seventh, and eighth semesters and the AT score is very low.

It can be seen that the correlation between the GPA of the first year and its AT score is higher than in other years.

The correlation between the GPA of the graduates and their AT score is seen to decrease uniformly from the first year to the fourth year.

The analysis of variance showed that the common parameters of the regression analysis provided a good fit for each equation to represent the predictions. In other words, the values of *F* and *P* were found to be statistically significant.

We also examined how the UGPA of the graduates was predicted by factors such as the GPA of the first year and the AT score.

**Table 7:** Correlation between the UGPA of graduates and their first-year GPA, AT score.

Model 3b.															
Univer sities	N	R	R <sup>2</sup>	ANOVA	b <sub>1</sub> - b <sub>5</sub>	b <sub>6</sub>	b <sub>7</sub>	b <sub>8</sub>	Beta						
				P	P	P	P	P	x	z	k	xz	xk	zk	t
NUM	251 8	0.72 8	0.53 0	0.000	0.000	0.733	0.75 4	0.04 8	0. 37	0. 44	0.11 2	0.10 6	- 0.00 6	0.00 6	0.03 4
Regression equation: Y=0.785+0.259x+0.305z+0.001k+0.035xz-0.002xk+0.002zk+0.008t, x-first semester GPA, z-second semester GPA, k-AT score, xz, xk, zk, t-moderator															
Univer sities	N	R	R <sup>2</sup>	ANOVA	b <sub>0</sub>	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	Beta						
				P	P	P	P	P	x	z	t				
NUM	420 7	0.75 7	0.57 3	0.000	0.00 7	0.00 0	0.00 0	0.10 6		0.71 5	0.089	0.019			
Regression equation: Y=0.796+0.594x+0.001z+0.01t, x-first year GPA, z-AT score, t-moderator															
MSUE	177 6	0.79 2	0.62 8	0.000	0.00 0	0.00 0	0.00 0	0.29 6		0.77 2	0.066	0.016			
Regression equation: Y=0.89+0.65x+0.000z+0.007t, x-first year GPA, z-AT score, t-moderator															
UFE	853 9	0.80 4	0.65 4	0.000	0.00 0	0.00 0	0.00 5	0.72 5		0.76 8	0.072	0.009			
Regression equation: Y=1.320+0.524x+0.001z+0.003t, x-first year GPA, z-AT score, t-moderator															
Total	683 6	0.76 7	0.57 7	0.000	0.00 0	0.00 0	0.00 0	0.24 2		0.72 2	0.099	0.01			
Regression equation: Y=0.939+0.577x+0.001z+0.005t, x-first year GPA, z-AT score, t-moderator															

**Description of the results:**

The correlation between the GPA of graduates and their first year GPA, AT score, is 0.76, indicating a positive and strong correlation.

From the table we see that 57.7% of the graduate’s UGPA is explained by factors such as the GPA of the first year and the AT score.

For Model 3b, the Beta values show that the first year GPA accounts for 72.2% of the effect, and the AT score accounts for 9.9%, while the effect of the moderator variable is 0.009. It can be seen that the effect of the AT score is relatively smaller than the effect of the first-year GPA.

For Model 3b, the coefficients  $b_0, b_1, b_2$  of each regression equation are significant, indicating separate direct effects. However, the significance level of the coefficient  $b_3$  or the

constant of the moderator variable is greater than 0.05, although the assumption that it has an effect is rejected, but it is not considered that there is no effect of the moderator variable. This can be seen in the Beta values.

For Model 3, it was determined by analysis of variance that the regression equations were statistically significant or could reliably represent the model.

**3.4. Correlation between the UGPA of the graduates and their AT score, high school average certificate scores**

This analysis included 2,259 MULS graduates and 2,288 MSUE graduates with high school average certificate scores. Then the following results were obtained.

**Table 8:** Correlation between the AT score of high school graduates and their average certificate score.

Model 4a							
	N	R	R <sup>2</sup>	ANOVA	Regression equation	b <sub>0</sub>	b <sub>1</sub>
				P		P	P
MSUE	5288	0.36 6	0.13 4	0.000	Y=94.871+5.424x	0.00 0	0.00 0
MULS	2259	0.30 6	0.09 4	0.000	Y=253.352+3.238x	0.00 0	0.00 0
Total	7547	0.35 9	0.12 9	0.000	Y=127.782+4.941x	0.00 0	0.00 0



**Table 9:** Correlation between the UGPA of the graduates and their average certificate score.

Model 4b							
Universities	N	R	R <sup>2</sup>	ANOVA	Regression equation	b <sub>0</sub>	b <sub>1</sub>
				P		P	P
MSUE	5288	0.335	0.112	0.000	Y=0.685+0.027x	0.000	0.000
MULS	2259	0.426	0.182	0.000	Y=0.133+0.031x	0.276	0.000
Total	7547	0.375	0.141	0.000	Y=0.393+0.029x	0.000	0.000

**Table 10:** Correlation between the UGPA of the graduates and their average certificate score, AT score.

Model 4c. x-average certificate score, z-AT score, t-moderator												
Universities	N	R	R <sup>2</sup>	ANOVA	Regression equation	b <sub>0</sub>	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	beta		
				P		P	P	P	x	z	t	
MSUE	5288	0.429	0.184	0.000	Y=0.470+0.020x+0.001z+0.026t	0.000	0.000	0.000	0.000	0.245	0.272	0.058
MULS	2259	0.454	0.206	0.000	Y=0.161+0.028x+0.001z+0.023t	0.2	0.000	0.000	0.008	0.381	0.155	0.050
Total	7547	0.453	0.206	0.000	Y=0.150+0.023x+0.001z+0.023t	0.039	0.000	0.000	0.000	0.289	0.259	0.049

**Description of the results:**

The correlation between the AT score of the graduates and their average certificate score is 0.359, while the correlation between the UGPA of the graduates and their average certificate score is 0.375. This shows a weak and positive correlation.

The correlation between the UGPA of the graduates and the average certificate score, the AT score, is 0.453, which shows a positive and weak correlation and is statistically significant.

We also see that 14.1% of the UGPA of the graduates can be explained by the average certificate score, while 20.6% is explained by the average certificate score, the AT score, and the moderator effect.

According to the beta values of Model 4c, the average certificate score accounts for 28.9% of the effect, the AT score for 25.9%, while the moderator effect is 4.9%. It can be seen that the UGPA

of the graduates is affected by the average certificate score slightly more than the AT score. Also, it can be seen that the moderator effect is relatively small.

In Model 4c, coefficients b<sub>0</sub> are not influential for the MULS, while others are influential or significant. In other words, it can be seen that the average score of the certificate, AT score, is related to the UGPA of the graduates and will affect it to some extent.

For Model 4a, Model 4b, and Model 4c, the regression equations were found to be statistically significant or capable of reliably representing the model through analysis of variance.

**3.5. Correlation between the UGPA of the graduates and their AT score (for each year of graduation).**

**Table 11:** Correlation between the UGPA of the graduates and their average certificate score, AT score (for each year and graduation).

Model 5: x-average certificate score, z-AT score, t-moderator													
Year	N	R	R <sup>2</sup>	ANOVA	Regression equation	b <sub>0</sub>	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	beta			
				P		P	P	P	x	z	t		
<b>MULS</b>													
2016	742	0.394	0.155	0.000	Y=0.051+0.024x+0.01z+0.022t	0.836	0.000	0.000	0.158	0.319	0.176	0.048	
2017	853	0.484	0.234	0.000	Y=0.196+0.028x+0.01z+0.026t	0.305	0.000	0.000	0.056	0.402	0.164	0.058	
2018	664	0.484	0.234	0.000	Y=0.419+0.033x+0.01z+0.023t	0.075	0.000	0.000	0.154	0.435	0.113	0.049	
<b>MSUE</b>													
2019	1442	0.357	0.127	0.000	Y=0.703+0.019x+0.01z+0.027t	0.000	0.000	0.000	0.016	0.234	0.205	0.061	

2020	1814	0.469	0.220	0.000	$Y=0.251+0.021x+0.002z+0.021t$	0.10	0.00	0.00	0.03	0.253	0.30	0.04
						2	0	0	2		6	6
2021	2032	0.445	0.198	0.000	$Y=0.537+0.019x+0.002z+0.026t$	0.00	0.00	0.00	0.00	0.241	0.29	0.05
						0	0	0	4		0	9

### Description of the results:

For each year, the average certificate score has a slightly greater impact on the UGPA of graduates than the AT score.

According to data from two universities, for three consecutive years, the correlation between the UGPA of the graduates and the average score of the certificate, the AT score has increased. In other words, it is considered that the possibility of predicting the UGPA of graduates by two factors is greater than the previous year.

The effect of the moderator variable is between 0.046 and 0.061.

### Conclusion and Discussion

Based on our research result we are suggesting following conclusions. Model 4a indicates that there is a weak correlation between high school certificate average scores and admission test scores. The Ministry of Education must consider this issue and find the reason for this.

The regression equations derived from the regression analysis are statistically significant and reliable in each case, so they are considered to be of practical importance for policy makers and university admission policies.

The correlation of the average certificate score of high school graduates was found to have a high influence on the UGPA of the graduates. Therefore, it is appropriate to focus more on the weight of the average high school certificate score of the applicants than on the admission test score.

Furthermore, the model that correlated the UGPA of the graduates with the average certificate score, AT score, and the first year GPA was better than the other models. In other words, these indicators are the 3 factors that have the main influence on the academic achievement of university students. Therefore, for the Ministry of Education, it can be seen that it is possible to improve the quality of pre-university education and to take measures to support the learning conditions of students admitted to the university.

Although reliable regression equations and prediction models were determined, it was seen that the AT score has a small effect on the academic achievement of the graduates. In part, this indicates the need to re-examine the validity and reliability of the admission tests.

This study can be extended with a comparative study for public and private universities. Other factors can also be modelled. In other words, it can be studied and modelled depending on the results of the two highest scores of the student's AT, living environment and school environment, scholarships, socioeconomic status, etc.

**Acknowledgement:** The first named author is supported by Fundamental Research Project Grant, Mongolian Foundation of Science and Technology, Mongolia, under award number ShuSs-2020/48 and the second named author is supported by Fundamental Research Project Grant, Mongolian Foundation of Science and Technology, Mongolia, under award number ShuSs-2020/51.

### References

1. N. R. Kuncel, S. A. Hezlett & D. S. Ones, A comprehensive meta-analysis of the predictive validity of the Graduate Record Examinations: Implications for graduate student selection and performance, *Psychological Bulletin*, pp. 162-181, 2001.
2. N. W. Burton and M. Wang, Predicting Long-Term Success in Graduate School: A Collaborative Validity Study, Education Testing Service, Princeton, NJ, 2005.
3. W. G. B. D. Bowen, the shape of the river: Long-term consequences of considering race in college and university admissions, Princeton University Press, 1998.
4. B. Bridgeman, J. Pollack and N. Burton, Predicting Grades in College Courses: A Comparison of Multiple Regression and Percent Succeeding Approaches, *Journal of College Admission*, 6. 199, pp. 19-25, 2003.
5. B. Bridgeman, N. Burton and F. Cline, Understanding What the Numbers Mean: A Straightforward Approach to GRE Predictive Validity, Education Testing Service, Princeton, NJ, 2008.
6. J. Vulperhorst, C. Lutz, R. d. Kleijn and J. v. Tartwijk, Disentangling the predictive validity of high school grades for academic success in university, *Assessment & Evaluation in Higher Education*, p. 17, 2018.
7. T. Luvsandorj and B. Shurentsetseg, in mongolian, Qualitative analysis of students high school certificate, general admission test score and grade point average, Proceedings of International Conference "Education quality and outcomes", Ulaanbaatar, Mongolia, 2018.

**Copyright:** © 2024 Amarzaya A. This Open Access Article is licensed under a [Creative Commons Attribution 4.0 International \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.