

# Visualizing the Characteristics of High Performing College Students

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**In this study, we tried to understand the characteristics of college students with excellent academic records by analyzing their academic records from admission to graduation using the data visualization software. The subjects of this study were students with a graduation GPA of 4.0 or higher among students that enrolled to A college in 2012. While the GPAs of these subjects were generally higher than 4.0 in regular semesters, their GPAs in summer or winter sessions were comparatively various, ranging from 3.0 to 4.5. This study found that more than half of the subjects enrolled in the college through the admission type of "General A(in Korean, Jeong-Si-Ga-Gun)", and that they earned higher grades in 'general selection' courses and 'teacher licensing' courses. This study also found that GPAs of their first semester and those of their graduation had a relatively high correlation, and that their course evaluation scores and graduation GPAs had a low correlation. It is expected that by analyzing and monitoring the academic records of college students with excellent academic ability, specially utilizing data visualization software, the college will be able to more efficiently and successfully support the academic performance of its excellent students.**

**Keywords: data visualization, college student, academic performance, academic record, GPA**

## INTRODUCTION

The learning ability of human beings has a great influence on the whole life of the individual and is a key driving force for human and social growth. Lee & Sung(2011) focused on Albin Toffler's argument in the book, "Revolutionary Wealth" (Toffler & Toffler, 2006), "the economic core resource that creates wealth for the future society is knowledge and that the ability to acquire knowledge is the source of new wealth and success," and insisted that learning ability to acquire knowledge is one of the core competencies that future talent must have. The issue of Learning has been very important in all societies over time, and surely in the current and future society in which the fourth industrial revolution dynamically takes place.

The learning ability is an important part of all ages, but one of the most important phase of learning issues is the college that many students will encounter before taking their first steps into society. Most universities will try to ensure that students maximize their learning ability to achieve superior educational outcomes. Most students try to do so as we might find by the study that showed significant correlation between academic achievement and college life satisfaction (Kim & Kim, 2015).

In order to spread the academic success in college, it is necessary to understand students who are excellent in academic achievement. Yang(2015) derived the elements of learning motivation and learning behavior through qualitative case study of college students with excellent academic achievement. It is also important to draw more vivid results through qualitative research, but at the same time, various analyses based on quantitative data from the college level are also necessary. The purpose of this study is to investigate the basic characteristics of students who have the highest level of academic achievement in college based on college-level database. In addition, we would like to analyze the differences in student activities and personal characteristics between academically excellent students and general students. Through this study, it will be possible to strengthen the feedback system of educational performance management by understanding characteristics of excellent students. It is also expected to provide guidelines for improving the quality of college education.

## Analysis of student achievement

Academic achievement data were collected and analyzed from students who ended with GPA 4.0 or higher among "A" University Students who entered in 2012 and graduated by the first semester of 2016. In

addition to the grades of the students by school year, the grades by college, department, and subject are also examined. This will lead to understanding the present situation and best practices of students with excellent credits at A University.

### Analysis of difference between excellent student and general student

"A" University Students who entered in 2012 and graduated by the first semester of 2016 will be divided into excellent academic students and general students based on whether their graduation GPAs are higher or lower than 4.0. The comparisons between these two groups will explore the relationship between various variables such as admission type, entrance examination, scholarship award period, and lecture evaluation. This leads to differences between excellent students and general students.

## METHODOLOGY

"A" University Students who entered in 2012 and graduated by the first semester of 2016 were selected as subjects. The reason why research subjects were selected among 2012 freshman was because the enrollment data, which is one of the student-related variables, before 2012 cannot be selected as the data retention period is only 5 years. In order to group the students who have excellent academic achievement, students with a grade of 4.0 or higher were selected as those with excellent academic achievement. As the results, a total of 840 students were selected, 75 of whom were excellent students, and 765 were general students. The subjects of this study are shown in Table 1.

Table 1. Subjects

group		Freq.	%
Gender	Male	199	23.7
	Female	641	76.3
GPA	A+ (4.1~)	120	13.7
	A0 (3.6~4.1)	278	31.7
	B+ (3.1~3.6)	279	31.8
	B0 (2.6~3.1)	145	16.5
	C+ (2.1~2.6)	55	6.3
Total		840	100.0

This study selected the research subjects based on student basic data of A university's Office of Research Institute and Assessment and analyzed the relationship and trends between academically excellent students and general students based on the activity variables and the student basic data.

Student basic data and the academic achievement trends were visualized using Spotfire and analyzed using SPSS 18.0.

## RESULTS

### Analysis of academic data of excellent students

#### Analysis by school year

The GPAs of students with excellent academic achievements are generally in the range of 3.9 to 4.2. The highest GPA was 4.5 and the lowest GPA was 3.0.

In 2012, which is their entry year, it was found that academically excellent students generally earned a grade of 4.0 or higher in the first and second semesters. Nine students took summer and winter sessions, and their scores ranged from 4.5 to 3.0.

In 2013, the academically excellent students earned 4.1 and over in the first semester and the second semester in average, and the average GPA of these students was 3.58. There were 22 students in the summer and winter session in 2013 and their scores were 4.5 and 3.0 respectively.

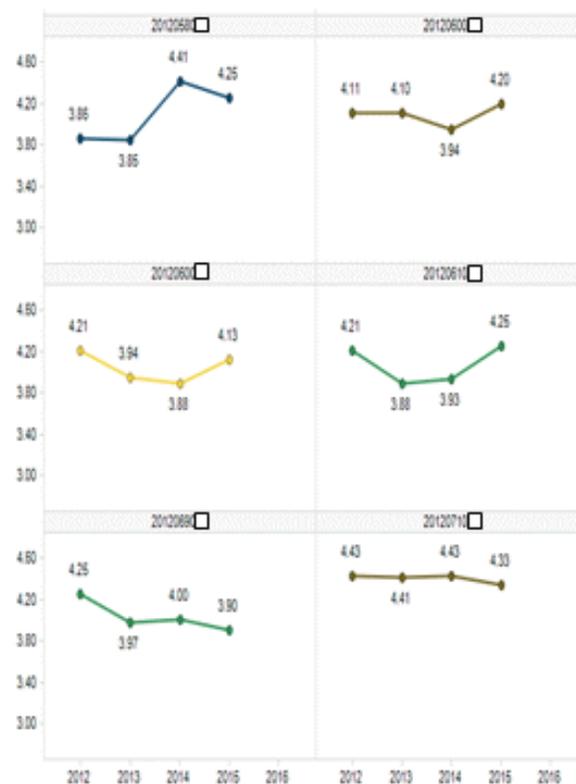


Figure 1. Examples of Excellent Students' GPAs by school year

The average GPAs of academically excellent students in 2014 was improved in comparison to 2012 and 2013. The first semester average GPA was 4.15 and the second semester is 4.17. And, the lowest GPA was 3.6. The grades of seasonal sessions were also higher than the previous years. Average scores of

summer session and winter session are 4.14 and 4.12, respectively.

The average GPA of excellent students in 2015 is 4.15 for the first semester and 4.08 for the second semester, which is slightly lower than in 2014. On the other hand, the grades of seasonal session are higher than the regular semester grades. The average grades in the summer session and winter session are 4.35 and 4.20, respectively.

In 2016, 66 out of the 7In 2016, 66 out of the 75 students selected as academic excellence students graduated in February 2016, with 9 students in the first semester of 2016. The average grade of these students is 3.92, which is lower than before. The highest grade among the 9 students was 4.5 and the minimum grade was 3.0.

### Analysis by course classification

Looking at the trends in average grades by course classification of academically excellent students, the average grade of general elective subjects is the highest as 4.5 for 2012. And, the average grade of major subjects is the highest as 4.25 in 2013, and those of general elective subjects and teaching essential subjects are the highest as 4.25 in 2014. In the case of 2015, the highest average grade was found as 4.39 for the teaching essential subjects, and in 2016, it was found at general elective subjects. The average grades of academically excellent students are generally higher in general selection and teaching essential subjects.

### Comparison of academically excellent students and general students

#### Comparison by Admission type

The average entrance score of students who entered through the early admission type("Su-Si") was 93.72 and the average graduation GPA was 3.52. The relationship between entrance scores and graduation GPAs of students through the early admission type is shown in the Figure 2.

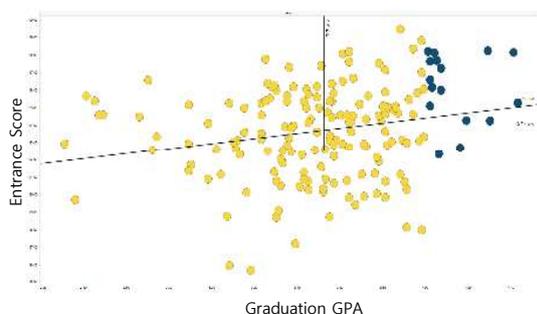


Figure 2. Relationship of Entrance scores and graduation GPA of students of General A admission

The average entrance score of the admission type of General A(in Korean, "Jeong-Si-Ga-Gun") was 908.58 and their average graduation GPA was 3.46, which are a little lower than those of the early admission type. Students who entered through the major aptitude admission showed relatively low entrance scores because the screening of this admission used scores differently. There were 30 academically excellent students in General A admission(Jeongsi-ga-gun), and among them, there were 1 student in major aptitude admission, and 1 in athletics admission.

The average entrance score of students through the admission type of General B("Jeong-Si-Na-Gun") was 942.92 and their graduation GPA was 3.51. And the number of academically excellent students in this admission type is 13. The relationship between entrance scores and graduation GPAs of students through the admission type of General B is shown in the Figure 3.

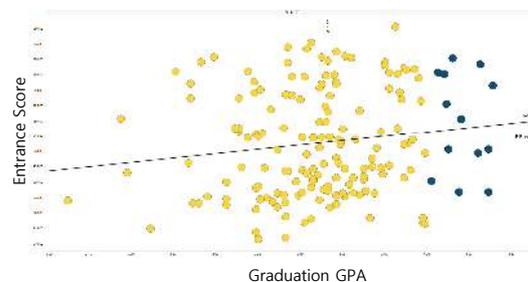


Figure 3. Relationship of Entrance scores and graduation GPA of students of General B admission

There was no academically excellent student in the additional admission, and the average entrance score of students by the additional admission was 942.10 and their graduation GPA was 3.31.

The crosstab analysis was conducted to test whether there are meaningful differences in the ratio of academically excellent students by the type of admission. However, it turned out that there is no significant difference. The results are shown in Table 2.

Table 2. Excellent students by the admission type

Admission Type	Students		$\chi^2$ (p)
	Excellent	General	
Early Admission	23	263	.502 (.478)
General A/B	52	494	
Additional Admission	0	8	-
Total	75	765	

Looking at more specific types of admission, among 23 academically excellent students by the early admission, there are 1 student by the admission for specialized high school graduates, 6 students for talent training, 1 for foreign students, 5 for high

scorers of scholastic aptitude test, and 10 for high graders in specific subjects. Among 52 academically excellent students by the admission type of General A/B, there are 4 students by the admission type of specialized high school graduates, 1 for athletics, 1 for major aptitudes, and 46 for general admission.

### Comparison by Scholarship

The average entrance score of students who entered through the early admission type ("Su-Si") was 93.72 and the average graduation GPA was 3.52. The relationship between entrance scores and graduation GPAs of students through the early admission type is shown in the Figure 2.

Comparing students by the number of semesters in which they received scholarship, academically excellent students received for more than 6 semesters during 8 semesters, from their entrance to graduation. The average graduation GPA of students who received for 7 semesters was highest at 4.14, and those for 8 semesters were next, and those for 6 semesters the next. In case of general students, the numbers of semesters in which they received the scholarship ranged from 0 to 8 semesters, and the more often they received scholarship, the higher graduation GPAs they tend to receive. General students who received scholarship for 8 semesters showed the highest average graduation GPA, 3.58.

The crosstab analysis was conducted to test whether there are meaningful differences in the numbers of semesters in which they received scholarship between academically excellent students and general students. The results showed that there were significant differences (Table 3).

Table 3. Number of semesters with scholarship

# of Semesters	Students		$\chi^2$ (p)
	Excellent	General	
0	0	10	36.26 (.000)
1	0	20	
2	0	21	
3	0	31	
4	0	51	
5	0	64	
6	4	98	
7	22	181	
8	49	289	
Total	75	765	

### Comparison by Lecture Evaluation

The average points of the lecture evaluation is 4.08 and the average GPA is 3.48. It can be confirmed that there is a low relationship between the points of the lecture evaluation and the graduation GPAs. The average score of lecture evaluation was highest in

veterinary college, and lowest in college of social studies.

The crosstab analysis was conducted to test whether there are meaningful differences in the lecture evaluation between academically excellent students and general students. The results showed that there were not significant differences (Table 4).

Table 4. Lecture evaluation

Lecture evaluation	Students		$\chi^2$ (p)
	Excellent	General	
4.5~5.0	25	153	7.62 (.055)
4.0~4.5	19	259	
3.5~4.0	24	279	
~3.5	7	74	
Total	75	765	

## CONCLUSIONS AND IMPLICATIONS

The purpose of this study is to investigate the trends of academic achievements of academically excellent students, whose graduation GPA is higher than 4.0, in regard to their colleges, admission type, subject classification, lecture evaluation and so on. And, this study also compared academically excellent students with general students. The results of this study are summarized as follows.

First, students with high academic achievement generally earned a grade of 4.0 or higher in regular semesters, and in the case of seasonal sessions, the distribution of scores varied from a minimum of 3.0 to a maximum of 4.5.

Second, the departments of academically excellent students showed average GPAs of more than 4.0, but in the last semester, most of them showed lower GPAs than the previous semester.

Third, academically excellent students showed higher scores in general selective subjects and teaching essential subjects. This seems to be due to the differences in the grading system based on school regulations.

Fourth, more than half of academically excellent students entered the college through the admission type of General A ("Jeong-Si-Ga-Gun").

Fifth, academically excellent students received scholarships for more than 6 semesters during 8 semesters. The amount of scholarship they received was between 12,000,000~18,000,000 KRW. However, the correlation between amounts of scholarships and graduate GPAs turned out to be low. This is presumably due to the inclusion of national scholarships, which is given regardless of academic achievements.

Sixth, the average GPA of the first semester was 3.26 and the average graduate GPA was 3.48, and

there was a relatively high correlation between the first semester's GPAs and the graduate GPAs.

Seventh, in the relation between lecture evaluation and graduate GPAs, the mean point of lecture evaluation was 4.08 and the average graduate GPA was 3.48. There was a low correlation between the lecture evaluation and the graduate GPAs.

The implications of the results for future data collection/analysis and the improvement of undergraduate programs are summarized as follows. First, the most critical characteristic of academically excellent students was identified as the academic achievement in the first semester after admission. At the university level, based on these results, it is necessary to find a way to sustain and improve the learning motivation of freshmen by managing and improving the quality of education programs.

Second, it is necessary to devise an honorization plan for academically excellent students (and graduates). For example, Dean's list is available for excellent students on a semester basis. In the case of graduates, it is necessary to mark and honor the diploma with Summa Cum Laude, Magna Cum Laude, Cum Laude, etc., and continuously and periodically manage and support them even after graduation.

Third, more intensive analyses are needed on the characteristics of academically excellent students. In the future, it is necessary to analyze characteristics of excellent students through data related to various aspects such as curriculum aspects, counseling, employment, and college life.

Fourth, besides quantitative data, analyses using qualitative research methods such as interviews and observations need to be added. It should be explained "how" and "why" some students could become academically excellent students by considering more various aspects such as learning method, school life, adaptation, future aspiration, and high school life, and what characteristics they show in terms of competences such as creativity and aggressiveness? And it is necessary to try a comprehensive analysis of a mixture of quantitative and qualitative data. This approach is difficult to implement on a large scale every year, so it needs to be carried out at regular intervals (biennial, three years, five years, etc.).

Fifth, it is necessary to follow up the life of excellent graduates. For example, it is possible to investigate typical cases such as employment, marriage, happiness, satisfaction, pride in college, contribution to alma mater such as participation at alumni association, and donation to development fund. It is necessary to conduct a longitudinal study (about 10 graduates of each year) on excellent graduates.

Finally, it is necessary to conduct an in-depth investigation and analysis on students who showed poor academic performance or academic maladjustment. It is necessary to anticipate academic failure through big data related to academic performance and school life (library, eCampus, etc.)

in advance, and to prevent, or actively support students with academic difficulties.

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