

Comparative Analysis of Academic Achievement of University Students Coming from Single-Sex and Coeducational Schools: A Study in Suleyman Demirel University, Almaty, Kazakhstan

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Abstract: Many studies (Malik & Mirza, 2014; O'Neill, 2011; Daniels et al., 2009; Murphy, 2008; Hughes, 2007) conclude that there are numerous advantages of single-sex schooling especially for gifted, minority and economically disadvantaged students. Both boys and girls positively get affected by single-sex educational environment; while boys can express themselves comfortably in arts and theatre, and girls' performance in mathematics and science subject has significantly improved (Martin & Beese, 2016; Leder, 2004). Both freed from opposite sex stereotype and intention of impressing opposite sex in educational process (Hughes, 2007). Past researches conclude (Murphy, 2008) that single-sex schooling also contributes positively for character building and moral development of students compared to co-educational schooling. The teachers who are the key players in educational process are varied in opinion about single-sex education (Sari, 2017; Spielhagen, 2011). The present study was carried out in the Suleyman Demirel University located in Kazakhstan. It was designed to find out the differences in academic performance of undergraduate degree programme students coming from single-sex and coeducational schools. Secondary source data was used for the analysis. Academic records of 8636 students were retrieved from the university management information system. This number of students were comprised of students who took admission from 2006-2007 academic year and graduated or left uncompleted. This number also includes students who are currently continuing the programme. Both descriptive and inferential analysis were applied. The study concludes that students from single-sex school took admission with significantly higher university entrance score. Students of single-sex schools were also granted significantly more government tuition fee waiver compared to counterparts. Hence, over the years the decrease in academic performance of single-sex students can be observed, graduated single-sex students had higher grand average compared to currently pursuing single-sex students. Moreover, even after taking admission higher score the grand average of currently pursuing single-sex students equalled (even slightly less) to students of coeducational schools. Female students from single-sex schools significantly took more admission in science and engineering disciplines compared to female students of co-educational schools.

Keywords: Single-Sex Schooling, Coeducational Schooling, Academic Performance of University Students

1. Introduction

After the collapse of the Soviet Union, single-sex schools, particularly high schools came into existence in Kazakhstan, which were opened by civil society institution Bilim-Innovation International Education Foundation (BIIEF). There were no such schools during the Soviet period time. After the independence of the Republic of Kazakhstan these single-sex schools were a trend as an alternative schooling offered for parents. These schools were located in almost every part of the Republic of Kazakhstan and admitted students of 6th standard on merit-based from. These schools can be categorized as schools for gifted

children and many of them carry names as “schools for gifted children”. The foundation (BIIEF) also runs vocational co-educational high schools and coeducation international schools as an option for parents. In Kazakhstan, in the public sector, the coeducational schools are widespread and the government do not run public single-sex schools.

The university for the study was Suleyman Demirel University (SDU) which is also run by BIIEF. Due to affiliation to same group of institutions the SDU has a plenty of number of students hailing from single-sex high schools making it as the most suitable place for field study. This is a different research endeavour compared to previous studies, instead of comparing performance of school pupils’ academic performance, the current study focuses on university students’ academic performance. This is particularly important in the context of Kazakhstan as in this country single-sex schools are comprised by private schools for gifted children. Comparing public co-educational school students’ academic performance with schools for gifted children will not be just. Academic performance is demonstrated by annual average and grand average.

Hughes (2007) in her research titled “The advantages of single-sex education” conducted in USA explores whether an educational administration should give an option for parents between co-education schooling, single-sex classroom education and single-sex schooling. The author argues that single-sex classroom or single-sex schooling is beneficial for academic improvement of school students; especially, it contributes positively to development of minority, poor and socially disadvantageous school children. The author also believes that single-sex education improves behaviour and character-building of children. She further states that in a single-sex educational environment especially in science classes there will not be gender based discrimination and prioritization of gender groups.

Hughes (2007) concludes that through single-sex education settings students will not have worries of appearance, fear of making mistake and intention to impress students of opposite sex; more time and energy will be spared for grasping the concepts and improving knowledge; which leads to less destruction and stress and further academic improvement. In Hughes’ research it was also vivid that, especially in science classes, the girls in single-sex setups demonstrate better performance through participation and showing keen interest. And on the other hand, boys in the single-sex environment “are more apt to participate in areas where emotions are expressed - or in the area of fine arts; such as, drama or music (p. 9).” Which is not much possible for boys to express themselves through art in front of girls. The Author also finds that in single-sex education system both boy and girl “students’ behaviour is improved in the areas of attendance, distractions, and participation, thus improving student achievement” (p.10).

Leonard Sax, the founder of the National Association for Single-Sex Public Education, believes, “The kind of learning environment that is best for boys, is not necessarily best for girls”. And hence, the author believes that boys and girls both have different traits in the learning process, and special attention should be put forward in the teaching process. Richard Hawley suggests, “Physiological and psychological differences between girls and boys require different teaching techniques at different times” (as cited in Hughes, 2007). Hughes (2007) states “in single-sex classes or single-sex schools, the teacher would be able to concentrate on the learning-styles of each sex and use the styles to bring out the academic best in each student. Lessons and activities could be designed with a single-sex in mind (p. 11).”

2. Research Questions

As numerous studies suggest (1) “does the single-sex education translates into more academically achieving students in Kazakhstan’s context” is the main research question. (2) “Is there change in performance of single-sex students over the years” and (3) “are single-sex students more likely to graduate the university” are other pressing questions. Another interesting fact to find will be (4) “are girl students of single-sex schools more likely to take admission in science and engineering disciplines”.

3. Objectives of the Study

These are the main objectives of the current study.

- To analyse if students from single-sex schools demonstrate higher academic achievement compared to student from coeducational students
- To develop policy suggestions for the Suleyman Demirel University, Bilim-Innovation International Education Foundation and the Government of Kazakhstan

4. Literature Review

Prendergast and O’Donoghue (2014) in their study titled “Influence of gender, single-sex and co-educational schooling on students’ enjoyment and achievement in mathematics” focused on how gender, single-sex and co-educational system aspects can affect enjoyment of and performance in mathematics. This study took place at four schools in Ireland; two being coeducational, one girls school and one boys school. Authors shared the general perception that mathematics is male domain rather than for girls and the study aimed to find if there is real base for this perception. This study also hoped to find out if girls demonstrate better performance in mathematics in single-sex schools. It was also stated that in Ireland it is common to send children to single-sex schools and that this educational system is widespread. In this study, Aiken’s two methods of scaling of mathematics as ‘Enjoyment Scale’ and the ‘Value Scale’ were applied for quantitative data collection. The authors of this study as mathematicians themselves also conducted four topics in the classes and assessed performance of students with the same examination papers to bring out correct picture of performance measurement. It was found out that male students significantly enjoy mathematics more than girls. After conducting four examinations it was found that girls outperform males, though, males enjoyed mathematics more than girls. And the study also found out that male students in single-sex school performed better in all four examinations compared to boys in co-education schooling and in the same way girls in single-sex schooling performed better in all four examinations compared to girls in coeducational system. It can be stated that both girls and boys can focus and perform better in single-sex schooling. This can be due to girls in single-sex can be more self-confident in demonstrating skills in mathematics rather than girls in coeducation dominated by notion of mathematics is for boys. This can be also projected in findings that girls in single-sex school like mathematics more than girls in coeducational schooling.

Malik and Mirza (2014), in their research compared the academic achievements of single-sex and coeducational primary school students in Pakistan’s Sindh region. Eight coeducational and eight single-sex schools were randomly chosen from pool of 128 schools in randomly selected districts, and sample size constituted 4448 students pursuing 5th standard. For the comparative analyse the board (government)

exam results were used. The findings concluded that students from single-sex schools significantly outperformed students of coeducational schools. And moreover, girl students of single-sex schools had higher score compared to boys; hence, in coeducational school boys performed better than girls. Authors draw on socio-economic fabric of Pakistan and how single-sex schooling is important from various angle. In concluding remarks, authors emphasize policy suggestion of more single-sex schools being established by government highlighting both academic and social advantage of this schooling type. It is also recommended for Women and Gender Studies centre to document and make catalogue of research works in single-sex schooling. As part of future research suggestions, authors put ideas as adding various demographic variable beside gender and schooling type in similar researches, and this current study addresses this perspective. Authors also suggest comparing from different subjects.

One of the landmark doctorate research on the topic is by O'Neill (2011) which focused on impact of single-sex education. For two years in quasi-experimental research she studied the effect of single-sex education on academic performance in two subjects. Though not statistically significant the positive effect of single-sex environment for economically disadvantaged students of primary school students was revealed in a selected school in North Carolina. The fifth-grade students were separated into single-sex boys class, single-sex female class and coeducational setup with similar demographic fabric voluntary based. After students being taught for one year standardized test was taken from two subjects. In the coming year again new batch of classes were established with the same teachers taking teaching experiment. The study has several limitations as small sample size and different teachers being assigned to separate classes. The research reveals detailed information about history of single-sex education in USA, benefits of this educational system and reviews immensely empirical researches conducted.

5. Methodology

To analyse the academic achievements of the SDU students' academic records from university management system will be drawn. SDU uses university management system from 2006. From database the 8636 undergraduate students' records were brought into spreadsheet. The collected data has records of graduated, left uncompleted and currently studying students.

SDU has undergraduate, master and doctorate programmes hence in this study just records of undergraduate students will be used. The SDU was chosen as a study because this university has good number of students from single-sex schools. As such SDU belongs to BIIE Foundation, and as stated before, in Kazakhstan only BIIE Foundation runs single-sex schools. And graduates of BIIEF schools prefer and opt to pursue higher education from this particular university. MS Office Excel will be used to filter the data and inferential analysis will be performed by Minitab 17 software. ANOVA test will be applied to analyse the difference and Chi-Square test was applied to analyse the association.

6. Hypotheses

- H_01 : There is no significant difference at the 5% level of significance between SchoolingType versus GrandAverage among Graduate students
- H_02 : There is no significant difference at the 5% level of significance between SchoolingType versus EntranceScore among Graduate students
- H_03 : There is no significant difference at the 5% level of significance between SchoolingType

versus GrandAverage among Studying students

- H₀₄: There is no significant difference at the 5% level of significance between SchoolingType versus EntranceScore among Studying students
- H₀₅: There is no significant difference at the 5% level of significance between SchoolingType versus Slope among students
- H₀₆: There is no significant association at 5% level of significance between SchoolingType versus IsEngineering among Female students
- H₀₇: There is no significant association at 5% level of significance between SchoolingType versus GrandAverage among Female students
- H₀₈: There is no significant difference at the 5% level of significance between SchoolingType versus StudentStatus excluded Studying students
- H₀₉: There is no association difference at the 5% level of significance between SchoolingType versus TuitionWaiver among all students
- H₀₁₀: There is no difference at the 5% level of significance between SchoolingType versus GrandAverage among BIIEF school students.

7. Descriptive Analysis of the Collected Data

Total academic record of 8636 undergraduate students were retrieved from database of university management system. These are the total number of students who were taken admission into undergraduate programmes from 2006 till 2018. Among them are the students who have graduated, currently pursuing the studies and those who have left without completing. Below is the table of variables along with their coding, and their classification, percentile analysis and scaling, and description.

Table 1: Descriptive analysis of the collected data

Variable and Coding	Categories, Percentile Analysis and Scaling	Description
Gender	Male = 4319 (50.01%) Female = 4317 (49.99%)	Variable “Gender” indicates the gender of students. Among 8636 students 4319 are male and 4314 are female students, which gives almost 50% distribution.
StudentStatus	Graduated = 3176 (36.78%) LeftUncompleting = 1373 (15.9 %) Studying = 4087 (47.33%)	“StudentStatus” indicates the current status of the student, these are statuses as graduated, and currently studying and as well “LeftUncompleting” those who have left the university without completing due to various reasons as transferred to other institutions, or expelled, or financial due, or even who took academic leave.

Faculty	F_ECO = 1484 (17.18%) F_ENG = 3214 (37.22%) F_LAW = 1626 (18.83%) F-PHIL = 2313 (26.77%)	Suleyman Demirel University has four faculties: SDU Business School (F_ECO), Faculty of Engineering and Natural Sciences (F_ENG), Faculty of Law and Social Sciences (F_LAW) and Faculty of Education and Humanities (F-PHIL).
IsEngineering	Engineering = 3214 (37.22%) NonEngineering = 5422 (62.78)	“IsEngineering” is a variable to indicate if a student is from Faculty of Engineering and Natural Sciences or not.
EntranceScore	EntranceScore without Nill value are 7123 (82.48%) EntranceScore with Nill value are 1513 (17.52%)	The Republic of Kazakhstan every year conducts nationwide university entrance examination. The maximum examination score is 140. Applicants have to score minimum 50 to be able to take admission in undergraduate programmes in higher educational institutions of Kazakhstan. Some students do not have entrance score due to this system has come into power later year after 2006. Students who transferred from another university and who graduate from professional college do not require an entrance examination.
IsBIIIEFS	BIIIEFS = 1768 (20.47%) NonBIIIEFS = 6868 (79.53%)	BIIIEFS stands for “Bilim-Innovation” International Educational Foundation Schools. As stated earlier BIIIEF Schools are comprised of both single-sex and coeducational schools and in Kazakhstan just BIIIEF has single-sex schooling system. “IsBIIIEFS” variable is going to indicate if student has graduated from BIIIEF Schools or not.
SchoolingType	Single-sex = 1517 (17.57%) Coeducational = 7119	Perhaps this is the most important variable as it indicates from which schooling system - single-sex or coeducation - student has

	(82.43%)	graduated.
TuitionWaiver	Yes = 3960 (45.85%) No = 4676 (54.15%)	“TuitionWaiver” variable indicates if student has been granted government tuition waiver scholarship or not.
GrandAverage	GrandAverage without Nill value are 8316 (96.29%) GrandAverage with Nill value are 320 (3.71%) Studying and GrandAverage with Nill value 23	GrandAverage is a grand average of student for 8 semesters, if student is a transferee than average for semester student studied. Some students do have GrandAverage due to they have started programme hence left without entering any exam. There are 23 Studying students with Nill value, they will be eliminated in hypothesis testing.
Slope	Slope is the slope of the linear regression line representing academic average for four years	477 graduated students do have average score for every academic year. This indicates in which slope value the student academic performance is inclined from initial year to final year.

8. Findings from Inferential Analysis of the Collected Data

Ten hypotheses are tested by MiniTab software. Each hypothesis testing along its results and interpretation are brought under one table for clear projection.

Table 2: Hypothesis testing 1

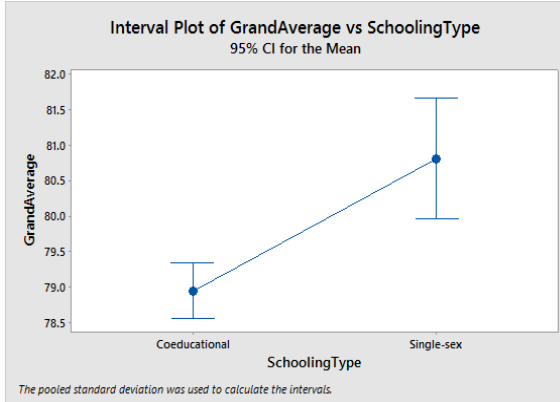
<p>H_0: There is no significant difference at the 5% level of significance between SchoolingType versus GrandAverage among Graduated students</p>																
<p>Analysis of Variance</p> <table border="1"> <thead> <tr> <th>Source</th> <th>DF</th> <th>Adj SS</th> <th>Adj MS</th> <th>F-Value</th> <th>P-Value</th> </tr> </thead> <tbody> <tr> <td>SchoolingType</td> <td>1</td> <td>1568</td> <td>1567.7</td> <td>15.30</td> <td>0.000</td> </tr> </tbody> </table>	Source	DF	Adj SS	Adj MS	F-Value	P-Value	SchoolingType	1	1568	1567.7	15.30	0.000	 <p>Figure 1. Interval Plot of GrandAverage vs Schooling Type</p>			
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Table 3: Hypothesis testing 2

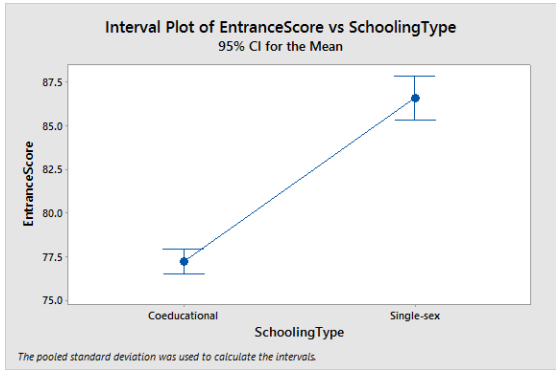
<p>H₀2: There is no significant difference at the 5% level of significance between SchoolingType versus EntranceScore among Graduated students</p>																												
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Table 4: Hypothesis testing 3

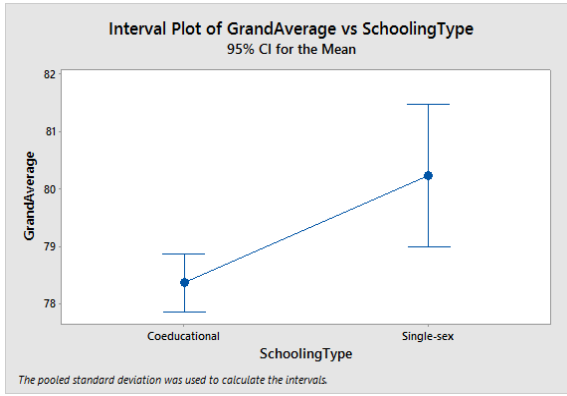
<p>H₀3: There is no significant difference at 5% level of significance between SchoolingType versus GrandAverage among Studying students</p>																												
<p>Analysis of Variance</p> <table border="1"> <thead> <tr> <th>Source</th> <th>DF</th> <th>Adj SS</th> <th>Adj MS</th> <th>F-Value</th> <th>P-Value</th> </tr> </thead> <tbody> <tr> <td>SchoolingType</td> <td>1</td> <td>557</td> <td>557.4</td> <td>2.15</td> <td>0.142</td> </tr> </tbody> </table> <p>Means</p> <table border="1"> <thead> <tr> <th>SchoolingType</th> <th>N</th> <th>Mean</th> <th>StDev</th> <th>95% CI</th> </tr> </thead> <tbody> <tr> <td>Coeducational</td> <td>3307</td> <td>73.554</td> <td>16.139</td> <td>(73.006, 74.103)</td> </tr> <tr> <td>Single-sex</td> <td>757</td> <td>72.603</td> <td>15.887</td> <td>(71.456, 73.750)</td> </tr> </tbody> </table>	Source	DF	Adj SS	Adj MS	F-Value	P-Value	SchoolingType	1	557	557.4	2.15	0.142	SchoolingType	N	Mean	StDev	95% CI	Coeducational	3307	73.554	16.139	(73.006, 74.103)	Single-sex	757	72.603	15.887	(71.456, 73.750)	 <p>Figure 3: Interval Plot of GrandAverage vs SchoolingType</p>
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Table 5: Hypothesis testing 4

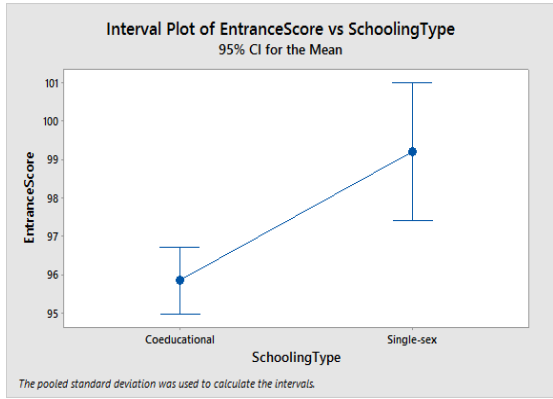
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Table 6: Hypothesis testing 5

<p>H₀5: There is no significant difference at the 5% level of significance between SchoolingType versus Slope among students</p>																												
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Single-sex	110	0.622	2.701	(0.152, 1.091)																								
<ul style="list-style-type: none"> • The P-value (0.651) is more than Alpha-value (0.05), we accept the Null Hypothesis and reject the Alternative Hypothesis. The result is that there is no significant difference at the 5% level of significance between SchoolingType versus Slope among students. • This means students coming from the single-sex schools have not demonstrated higher growth in academic average during four years compared to students from coeducational schools. Additionally both single-sex and coeducational students has slight demonstrated little growth from first year to final year in their academic average. 																												

Table 7: Hypothesis testing 6

H₀6: There is no significant association at 5% level of significance between SchoolingType versus IsEngineering among Female students

Pearson Chi-Square = 18.520, DF = 1, P-Value = 0.000

Tabulated Statistics: IsEngineering, SchoolingType

Rows: IsEngineering Columns: SchoolingType

	Coeducational	Single-sex	All
Engineering	817	129	946
NonEngineering	3071	300	3371

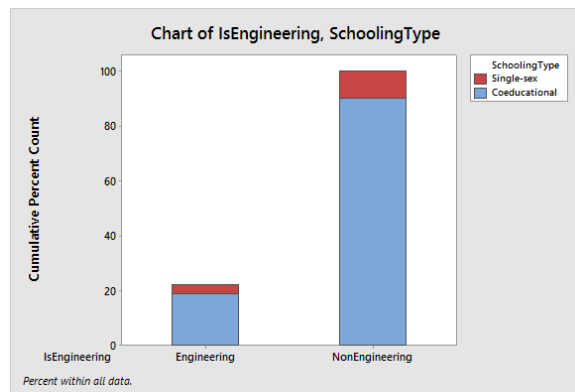


Figure 6: Chart of IsEngineering, SchoolingType

- The P-value (0.000) is less than Alpha-value (0.05), we reject the Null Hypothesis and accept the Alternative Hypothesis. The result is that there is a significant association at 5% level of significance between SchoolingType versus IsEngineering among Female students.
- This means among female students the single-sex school students comparatively took more admission in Faculty of Engineering and Natural Sciences compared to coeducational school students.

Table 8: Hypothesis testing 7

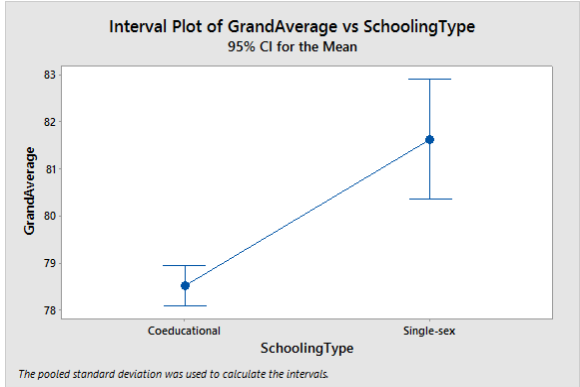
<p>H₀7: There is no significant association at 5% level of significance between SchoolingType versus GrandAverage among Female students</p>																												
<p>Analysis of Variance</p> <table border="1"> <thead> <tr> <th>Source</th> <th>DF</th> <th>Adj SS</th> <th>Adj MS</th> <th>F-Value</th> <th>P-Value</th> </tr> </thead> <tbody> <tr> <td>SchoolingType</td> <td>1</td> <td>3700</td> <td>3699.9</td> <td>20.64</td> <td>0.000</td> </tr> </tbody> </table> <p>Means</p> <table border="1"> <thead> <tr> <th>SchoolingType</th> <th>N</th> <th>Mean</th> <th>StDev</th> <th>95% CI</th> </tr> </thead> <tbody> <tr> <td>Coeducational</td> <td>3761</td> <td>78.534</td> <td>13.567</td> <td>(78.106, 78.962)</td> </tr> <tr> <td>Single-sex</td> <td>428</td> <td>81.637</td> <td>11.698</td> <td>(80.368, 82.906)</td> </tr> </tbody> </table>	Source	DF	Adj SS	Adj MS	F-Value	P-Value	SchoolingType	1	3700	3699.9	20.64	0.000	SchoolingType	N	Mean	StDev	95% CI	Coeducational	3761	78.534	13.567	(78.106, 78.962)	Single-sex	428	81.637	11.698	(80.368, 82.906)	 <p>Figure 7: Interval Plot of GrandAverage vs SchoolingType</p>
Source	DF	Adj SS	Adj MS	F-Value	P-Value																							
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<ul style="list-style-type: none"> • The P-value (0.000) is less than Alpha-value (0.05), we reject the Null Hypothesis and accept the Alternative Hypothesis. The result is that there is a significant difference at the 5% level of significance between SchoolingType versus GrandAverage among Female students. • This means the female students from single-sex school scored higher grand average compared to female students from coeducational schools. 																												

Figure 9: Hypothesis testing 8

H₀8: There is no significant difference at the 5% level of significance between SchoolingType versus StudentStatus excluded Studying students

Pearson Chi-Square = 4.146, DF = 1, P-Value = 0.042

Rows: StudentStatus Columns: SchoolingType

	Coeducational	Single-sex	All
Graduated	2624	552	3176
	69.20	72.92	69.82
LeftUncompleting 1373	1168	205	
	30.80	27.08	30.18

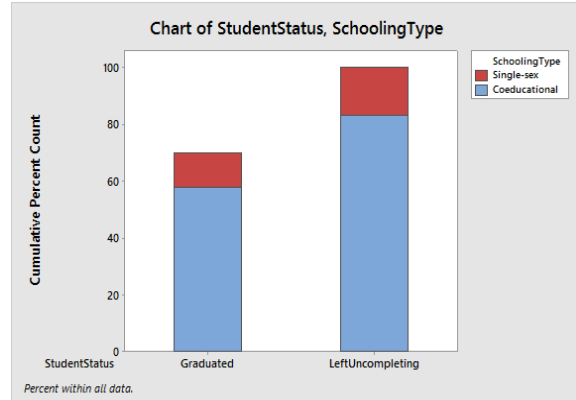


Figure 8: Chart of StudentStatus, SchoolingType

- The P-value (0.042) is less than Alpha-value (0.05), we reject the Null Hypothesis and accept the Alternative Hypothesis. The result is that there is a significant difference at the 5% level of significance between SchoolingType versus StudentStatus excluding Studying students.
- This means the single-sex school students are more likely to graduate the university compared to coeducational school students.

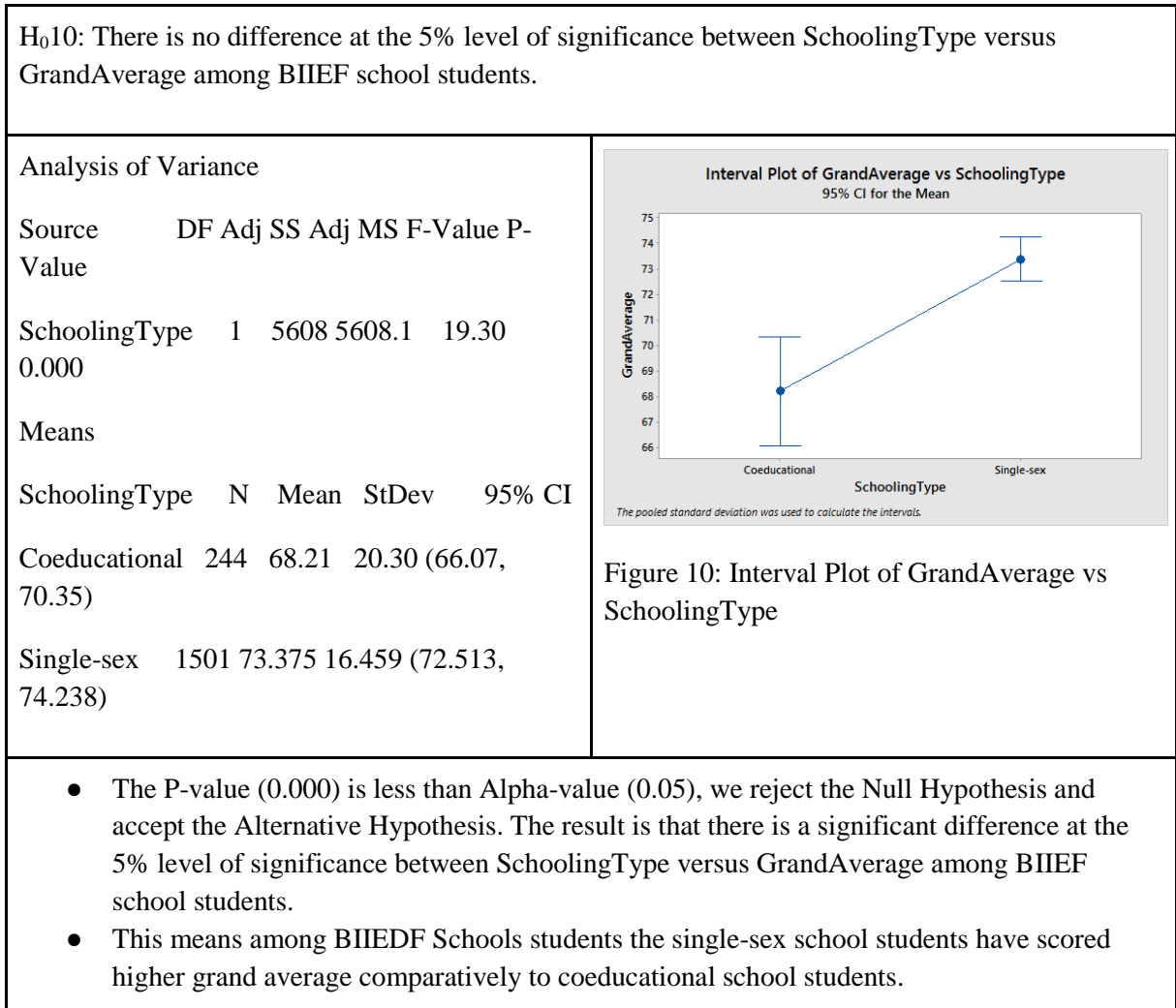
Table 10: Hypothesis testing 9

<p>H₀9: There is no association difference at the 5% level of significance between SchoolingType versus TuitionWaiver among all students.</p>			
<p>Pearson Chi-Square = 70.917, DF = 1, P-Value = 0.000</p>			
<p>Tabulated Statistics: SchoolingType, TuitionWaiver</p>			
<p>Rows: SchoolingType Columns: TuitionWaiver</p>			
	No	Yes	All
Coeducational	4003	3116	7119
	56.23	43.77	100.00
Single-sex	673	844	1517
	44.36	55.64	100.00

Figure 9: Chart of SchoolingType, TuitionWaiver

- The P-value (0.000) is less than Alpha-value (0.05), we reject the Null Hypothesis and accept the Alternative Hypothesis. The result is that there is a significant association at 5% level of significance between SchoolingType versus TuitionWaiver among all students.
- This means the students from single-sex schools have been granted more government tuition waiver scholarship comparatively to students from coeducational schools.

Figure 11: Hypothesis testing 10



9. Conclusion

By analysing the data of graduated students, it was found that students from single-sex schools took admission with higher university entrance score and achieved higher academic performance compared to coeducational students. By analysing the data of currently studying students it was found that students from single-sex schools took admission with higher university entrance score and however they have not achieved higher academic performance compared to coeducational students. Moreover, students from coeducational schools have slight better academic achievement (73.55% to 72.6%). It can be concluded that single-sex students those already graduated has demonstrated better academic achievement compared with current ones.

Students coming from the single-sex schools have not demonstrated higher growth in year-on-year academic average during four years compared to students from coeducational schools. That is single-sex

students are less progressive compared to coeducational students in their initial academic performance over the four years. Additionally, both single-sex and coeducational students has demonstrated slightly little growth from first year to final year in their academic average.

It is argued that single-sex schooling provides better platform for female students to opt so-called male subjects as engineering, science and mathematics, and believed leads better academic performance. By analysing the female students' data, it was found that female students from single-sex schools took more admission in engineering, science and mathematics and as well demonstrated higher academic achievement compared female students from coeducational schools.

By analysing graduation level of students, it was found that single-sex students are more likely to graduate university without leaving uncompleted. Republic of Kazakhstan provides tuition waiver scholarship for best performing students from nationwide university entrance examination score. And students from single-sex schools were awarded more grant compared to coeducational school students. This means the students from single-sex schools have been granted more government tuition waiver scholarship comparatively to students from coeducational schools. If we see just analyse data among BIIEF Schools students the single-sex school students have scored higher grand average comparatively to coeducational school students.

10. Discussion and Suggestions

In the findings it can be observed that students of single-sex school have taken admission with higher university examination and granted more government tuition waiver scholarship. As a policy suggestion the number of single-sex schools can be increased by BIIEF and government also can take up pilot single-sex school projects.

Single-sex school students also demonstrated higher grand average hence lately this is not the case. BIIEF administration should take into consideration and perform study why current students from its single-sex schools are not demonstrating better achievement event after taking admission with higher entrance score.

And plus year-on-year progress of single-sex students are also lower compared to counterparts. SDU administration can take up research and review why single-sex school students do not perform their full potentials. It is positive sign to see that single-sex schools positively effect upon girl students to take admission in engineering and science streams. Government and BIIEF can consider in establishing more girls' schools. As a future study comparative analysis of post university life of the students can be studied. And as well the study on parents' expectation from single-sex schools also will be an interesting research.

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