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DEPARTMENT OF ANATOMY

FACTORS AFFECTING DENTAL STUDENTS' SUCCESS IN ANATOMY AT A UNIVERSITY IN THE TRNC – A MULTI-PARAMETER ANALYSIS

M.Sc. THESIS

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Nicosia

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Declaration

I hereby declare that all information, documents, analysis, and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

Dr. Aylin Aktar

25/09/2021

Abstract

Factors Affecting Dental Student's Success in Anatomy at a University in the TRNC

A Multi-Parameter Analysis

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Anatomy is one of the most fundamental subjects in the curriculum for dental and medical students. It provides students with knowledge of the structure of the body and thus enables them to understand how it functions. It is also one of the courses with the highest failure rate. For educators, understanding factors that contribute to the success of students in anatomy courses could be helpful for early identification of potential high and low achievers with a view to provide appropriate support or adjust teaching styles. Past studies have looked at the role of various types of student related factors such as socioeconomic, family background, prior education, methods of study, lifestyle etc., but for the most part each study focused on one or two types of factors in each student group studied; hence making it difficult to know the relative role of the types of factors. This study aimed to review the role of multiple types of factors for success in all four semesters of the anatomy course, relating to the pre-Covid 19 pandemic period, in a group of dental students in the Turkish Republic of Northern Cyprus. It was conducted via an online, anonymous survey among 141 students.

Key Words: anatomy; academic success; academic achievement; dental students

Özet

KKTC'de Bir Üniversitede Dişhekimliği Öğrencilerinin Anatomi Başarısını Etkileyen Faktörler:
Çok Parametreli Bir Analiz

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Anatomi, diş hekimliği ve tıp öğrencileri için müfredattaki en temel konulardan biridir. Öğrencilere vücudun yapısı hakkında bilgi verir ve böylece vücudun nasıl çalıştığını anlamalarını sağlar. Başarısızlık oranı en yüksek derslerden biridir. Eğitimciler için, öğrencilerin anatomi derslerindeki başarısına katkıda bulunan faktörleri anlamak, uygun desteği sağlamak veya öğretim stillerini ayarlamak amacıyla potansiyel yüksek ve düşük başarılı kişilerin erken belirlenmesine yardımcı olabilir. Geçmişteki çalışmalar, sosyo-ekonomik durum, aile geçmişi, önceki eğitim, çalışma yöntemleri, yaşam tarzı vb. gibi öğrenciyle ilgili çeşitli faktörlerin rolüne bakmıştır, ancak çoğunlukla her çalışma, çalışılan her öğrenci grubundaki bir veya iki tür faktöre odaklanmıştır; bu nedenle, faktör türlerinin göreceli rolünü bilmeyi zorlaştırır. Bu çalışma, Kuzey Kıbrıs Türk Cumhuriyeti'ndeki bir grup diş hekimliği öğrencisinde, Covid-19 pandemisi öncesi döneme ilişkin anatomi dersinin dört yarıyılının tamamında, birden fazla faktör türünün rolünü incelemeyi amaçlamıştır. Çalışma, 141 öğrenci arasında çevrimiçi, anonim bir anket yoluyla gerçekleştirilmiştir.

Anahtar Kelimeler: Anatomi; Akademik başarı; Akademik kazanım; Diş Hekimliği öğrencileri

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List of Abbreviations

A&P:	Anatomy and Physiology
CHSSU:	Cyprus Health and Social Sciences University
COMLEX:	Comprehensive Osteopathic Medical Licensing Examination
DAT:	Dental Admission Test (USA)
GPA:	Grade Point Average
MCAT:	Medical College Admission Test (USA)
NBME:	National Board of Medical Examiners Exam (USA)
ÖSYM exam:	Öğrenci Seçme ve Yerleştirme Merkezi sınavı - Turkish national university entrance exam
PAT:	Perceptual Ability Test (USA)
TRNC:	Turkish Republic of Northern Cyprus
USA:	United States of America
USMLE:	United States Medical Licensing Exam
WAM:	Weighted Average Mark (Australia)

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CHAPTER I

This chapter describes the background of the subject matter, the importance of anatomy education and its relationship to success in the medical field, common issues with success in anatomy, the importance of being able to judge success predictors, and the aims and limitations of this research.

Introduction

Anatomy has a very long history as a formal discipline within the medical sciences. Understanding the structure of the human body and how it relates to function is the basis of medical and dental education and will allow students - future clinicians - to practice safely and competently. As anatomy educators for medical and dental schools, we want to teach our students to the best of our abilities to prepare them for their future as clinicians.

Anatomy is widely known as one of the hardest subjects in the basic medical sciences. Successful completion of an anatomy course has been linked to the successful completion of a first year medical-surgical - nursing course (Jeffreys, 2007). Regardless of institution, anatomy, together with physiology has the highest rates of failure amongst all courses at the undergraduate level (Hopper 2011). A 30-year retrospective study of more than two thousand students at a medical school in Croatia revealed that anatomy, together with embryology and histology is one of the most frequently failed subjects (Kruzicevic 2012). There is evidence that success in anatomy courses is a good predictor of overall success in medical school or other allied health sciences (Anderton et al., 2016; Sitticharoon et al., 2014). A six-year retrospective study with over five thousand students in an undergraduate anatomy course in the USA showed that eleven percent repeated the anatomy course at least once (Schutte 2015).

As such, what makes a student succeed or fail in university in general and in health sciences and more specifically in anatomy courses is of significant interest to academicians and administrators. Having this information may allow us to proactively reach out to and support students in their academic pursuits. In this study we aimed to review the role of various types of

factors for success in anatomy courses in a group of dental students in the Turkish Republic of Northern Cyprus.

Research Questions

We wanted to find out whether there was any difference in dental students' success in anatomy between different genders, age, their high school grade point average (GPA), whether they had taken biology in high school and if yes, whether their biology GPA was correlated with their anatomy grades, whether their parents' level of education made any difference in anatomy grades.

The aforementioned being background variables for the students, we were also interested in variables relating to their time in the university. We asked about whether they understood the subject matter during lecture, whether they liked the course, whether they found the course hard compared to their other subjects, what resources they used for studying, whether they had an outside job during their university semester and if so, how many hours per week they worked, and wanted to know whether any of these variables affected their anatomy scores.

Significance of the Study

As educators we want our students to learn to best of their capacity and we want them to take this information in a way that they can use for their entire career. As such, we strive to do our best for class instruction, try to develop a close relationship with our students and look for ways to improve our teaching style and methods. Students come to our classes with their own set of expectations, habits, circumstances and backgrounds. Knowing what makes a student more successful or more likely to fail may help us identify potential problem students earlier and adopt approaches to support them early in the semester.

As far as we could find in our literature research has shown, there are very few studies of this type from Turkey, even among all health sciences in general and none from the Turkish Republic of Northern Cyprus (TRNC). Of the available studies only one was specific to the subject of anatomy.

Further, the available studies from any of the countries are limited in terms of the scope of variables they cover.

Limitations

Approval for the study was obtained after the COVID-19 pandemic resulted in certain shutdowns and cease of face-to face teaching. Data collection was by survey. To keep the datasets comparable, we collected data only from prior semesters. That students were no longer in the university, and we could not have in-person interactions. Thus, the response rate to the questionnaire was lower than it could otherwise have been. Comparable prior surveys in our university have resulted in over 90% and mostly almost 100% response rate. For this study, the survey was sent remotely while the students were no longer at the university. The response rate was 60%, with a total subject number of 141. If we could have had an almost complete level of student participation the power of the analyses could have been greater.

For some variables where only a minority of students were in a certain category, statistically meaningful analyses were not possible. An example to this is whether having a job outside of the university influenced anatomy scores. In any of the semesters from which we collected data there were a total of 32 students who had ever worked, these were distributed across semesters. In some semesters there were as few as 7. We can presume that had we had a response rate closer to what could have been expected during a regular semester, we would have been able to conduct a statistical meaningful analysis even on the minority variables.

Another limitation is that this study was conducted with students from a single institution which makes it more difficult for the findings to be generalized for dental students in other institutions, even within the TRNC.

CHAPTER II

In this section we aim to summarize prior research into factors that play a role in students' success in anatomy courses, whether it is an anatomy course as part of a medical or dental degree or any other undergraduate health science degree. For this research we have not included teaching methods of the course, psychological and social factors or learning methods. Since there is relatively scarce research specific to anatomy and to dental students, we have taken into consideration relevant research that overlaps with or can be extrapolated to this group of students. We have looked at studies of general success in medical, dental school and veterinary school, success in anatomy in pre-graduate level courses and in allied health sciences degrees and specifically success in anatomy for dental and medical school. We paid special attention to any studies conducted in Turkey related to academic success in graduate level studies.

The factors playing a role in academic success that have been included in the scope of this research and literature review can be grouped into non-variable factors, meaning they are beyond the choices made by the student during his or her subject of study under evaluation, and variable factors that depend on the behaviour pattern, attitude, and lifestyle of the student.

The non-variable factors we looked at are gender, age, mother's and father's education, size of city in which their high school was, the type of high school attended, whether they studied biology in high school and if they did, their high school academic achievement in biology.

The variable factors are class attendance, listening during class, level of understanding of the lectures, like or dislike of anatomy, whether they found anatomy hard relative to other subjects, method of study, sources used for studying, work outside of school.

Literature Review

Gender

For pre-college level students there is a very large body of research looking into the role of gender. Majority of these studies find that female students perform better than their male counterparts. When we look at college and university level research the results become more mixed and seem to depend also on the course or subject being studied, the age group etc.
A study with 414 allied health students in Australia found that female students performed better than males in their first year when taking GPA as a criterion (Anderton, 2017).

Research into the role of gender in academic success of medical students also has a mixed result. A study from the UK puts having female gender as a predictor of academic success (Ferguson, 2002*),* whereas a study with dental graduates from the USA finds more nuance in that it is only older females who have an academic advantage and that at younger ages males perform better than their female counterparts (Stewart, 2006). Another study from a different medical school in the UK who followed 961 students found that males were more likely to have academic difficulties (Yates & James, 2006).

COMLEX is a standardized national exam that medical students graduating from osteopathic medical schools in the USA must take to get licensed. It consists of 2 exams. COMLEX Level 1 consists of all the pre-clinical subjects. In a study of 737 students at an osteopathic medical school in the US, there was no difference in COMLEX Level 1 performance between males and females after the data was controlled for their MCAT scores. MCAT is a score used as part of the students' medical school admission criteria. If the MCAT score was not controlled for, men had a statistically significant higher COMLEX Level 1 score. Women also had statistically significant higher clerkship evaluation scores than men. However, the medical school GPA, clinical subject examination scores and COMLEX Level 2 (clinical subjects) grades had no difference between genders (Dixon 2012).

In Austria, medical students must take a general knowledge test at the end of their first year of medical school. A study of 675 students showed that males showed significantly better

performance in this test. (Frischenschlager 2005). For perspective, in this study there were two other factors that correlated with success, which were having German as the mother tongue and high school GPA.

A large study from Jordan with 770 dental students showed that different subjects had different gender success patterns but that for overall cumulative GPA, females scored better than male students (Sawair, 2009). Among 1182 dental students in Brazil, female gender predicted a better academic performance (Da SilvA, 2010). A systematic review of medical students in Iran found that male students tended to fare behind female students in their overall academic achievement (Dolati, 2016).

For a group of 245 first year medical students in Thailand, gender did not influence anatomy scores (Sitticharoon, 2014).

In an Australian medical school, gender had no influence on academic outcomes except for a small affect in the fifth year of the 6-year degree program (Puddey 2014).

A ten-year study in the UK looking at levels of attrition in a medical school found that more males left than did females. 53% of the leavers were asked to leave due to academic reasons and the other 47% left due to personal reasons. In this study it is purported that attrition is a marker of academic failure (Simpson 1996).

Another study in the UK looked at medical students over five years, the ones who had academic difficulties were more likely to be male (Yates, 2006).

Using attrition as a marker for academic success in medical school, in a third world country, a retrospective study in Papua New Guinea found that there were no differences between gender among the rates of attrition. Among the same cohort, there was no difference among genders for completing the degree in its scheduled time or not (Tomdia-Lokes, 2020).

If we look at studies that investigated academic performance for the subject of anatomy, again we see mixed results for the role of gender. A study of 179 medical students at a US osteopathic medicine school found that males had significantly higher anatomy lecture examination grades than females, but laboratory and total grades were not significantly different between the genders. (Hintz et. Al., 2019).

A study conducted at two separate universities in the USA with 1274 students enrolled in undergraduate anatomy courses for health & science students, gender did not have any influence on course success outcome (Eleazer, 2018).

In a study with data covering six educational years, from 5133 students, enrolled in an undergraduate anatomy course in the USA, female students were more likely to repeat the course (remediate). However, in the same study comparing all exam results between remediators and re-mediators, females had higher grades on the first and fourth laboratory exams as well as total course grades then males. These are conflicting results. The authors conclude that gender was of minimal influence and that the statistics may be skewed due to total number of females being much larger in the study group. (Shutte, 2016)

Data from 602 students enrolled in an undergraduate anatomy and physiology class as part of various life sciences degrees in the USA showed that females had a significantly higher anatomy and physiology final grade than males. (Gwazdauskas, 2014)

There are a limited number of studies from Turkey on role of gender in success in university and graduate level studies. In one study in medical students in which the focus was on different learning styles, an overall academic achievement difference between genders was seen only in females who had a competitive learning style. (Kulac E. 2015). In a large study with over ten thousand students, albeit not in the medical sciences fields, the researchers found that female students enter university with lower grades but outperform males, even when controlled for field of study and other individual attributes (Dayıoğlu 2004).

The inconsistencies of these results regarding gender could be either because there was no real difference to start with, or they may reflect the differences between the countries, the degree studied for and other factors such as age and socioeconomic backgrounds which have not all been controlled for.

A retrospective analysis over 7 years at a College of Dentistry in the USA looked at 416 dental graduates using the Dental Admission Test (DAT) score, the score from the Perceptual Ability Test (PAT) of the DAT, and dental school GPA upon graduating as criteria for success. Females had significantly higher total entering GPAs and graduating GPAs than males. Males had significantly higher DAT scores, significantly higher PAT scores and significantly higher state board clinical examination scores than females. Further regression analysis was run to control for other factors that could affect the results on the state board clinical examination. When the PAT, numbers of amalgam restoration completed, and mock board exam clinical scores were controlled for, the effect of gender was no longer significant. (Stewart et al., 2006)

Separately, the influence of gender on academic success may be different as it interacts with age. This is discussed in next section, below.

Age

In a study from Australia, 421 students who entered a medicine programme were tracked for 7 years. Older age at entry to the programme was significantly correlated with weaker academic performance throughout the course as measured by the WAM (Weighted Average Mark) (Puddey 2014).

A study with 675 medical students in Austria found no significant influence of student age on academic success (Frischenchlager, 2005).

Among 1182 dental students in Brazil, age was inversely correlated with medical school GPA. The authors interpret this as overall student's performance being related to elapsed time between completion of high school and dental school admission (Da Silva, 2010).

Age was not a variable found to vary with performance in a study with 1274 students enrolled in undergraduate anatomy courses for health & science students in the USA (Eleazer, 2018).

Age Together with Gender

284 Medical students at a university in the USA were followed for 3 years. The Wilson AP scale, which is based on a combination of medical school GPA for each of the first three years, USMLE Step 1 and USMLE Step 2 scores and the fourth-year comprehensive clinical performance examination (CPX) was used as the measurement for success. Neither gender nor age independently were statistically significant main effects, but gender by age interaction was statistically significant. Older women performed better than older men and marginally better than younger women. Younger men performed better than older men. There was no statistically significant difference between older women and younger men (Haist, 2000).

Prior Academic Achievement

A systematic review performed in 2000 on factors related to success in medical school yielded enough data to perform a meta-analysis of previous academic performance. Medical college admission score, A levels and grade point average (GPA) were shown to be predictors of success with a small effect (Ferguson 2002).

In Thailand, students who want to study medicine have one year of pre-medical studies, followed by 2 pre-clinical years. The grade point average (GPA) in the pre-medical tear was directly correlated with anatomy grades in the pre-clinical year in a study with 307 medical students (Sitticharoon, 2014).

In one study, the quality of education prior to medical school as a variable was controlled for by following students who completed their pre-medical degree all at the same college in the USA. In this study, the students' score on the standardized test for medical school admission (MCAT)

and their undergraduate GPA were directly correlated to their score on one of the national exams they had to take (NBME 1) to qualify as medical doctors (Silver B 1997).

The MCAT (medical college admission test) test is a national standardized exam that students in the USA who wish to apply for medical school must take. According to a study of 737 medical students biological MCAT scores and undergraduate science GPA were significantly correlated with the GPAs in year 1 and year 2 of medical school (Dixon 2012).

A study from Australia found that undergraduate GPA and medical school entrance exam (Graduate Australian Medical Schools Admissions Test - GAMSAT) scores were consistent positive predictors for academic success in medical school courses (Puddey 2014).

A study from Austria showed that high school grade point average. (Frischenschlager 2005) had a positive correlation with overall academic achievement at the end of the first year of medical school.

A study at an osteopathic medical school in the USA looked at each component of the undergraduate GPA as well as the MCAT. While undergraduate GPA and MCAT scores including the biological sciences component correlated with success in first and second year of medical school, there was no significant difference in the strength of the correlation between the overall score and that of the biological sciences score (Agahi, 2017).

A study from Pakistan found a moderate correlation between pre-admission scores and success in the first year of medical school. This correlation weakened in the subsequent years of medical school (Luqman 2013).

A study using ten years' worth of data from a medical school, high school GPA and results of the MCAT found positive correlations with NBME scores for the basic sciences. Within the MCAT score, the MCAT biology, chemistry and quantitative skills analysis had the highest correlations (Meleca,1995).

A 30-year retrospective study of more than two thousand students at a medical school in Croatia revealed that medical school entrance exam grade and high school GPA were positively correlated with success at medical school (Kruzicevic 2012).

A study among Japanese medical and dental students used group-based trajectory modelling. For these dental and medical students during pre-clinical years the curriculum was the same. The students were grouped according to their pre-clinical years' GPA and analysed against various variables. It was shown that every point decline in high school GPA increased the odds of the student being in a lower trajectory group than the reference highest GPA trajectory and of being in a group of students who withdrew or repeated years (Nawa, 2020).

A twenty-year retrospective study in Brazilian dental school showed that dental school admission test score was a predictor of the students' overall performance as measured by their dental school GPA (da Silva 2010).

A study of US undergraduate anatomy students from three different courses in two different institutions looked at students' study styles as well as other demographic variables in relation to their success in the anatomy course. These students were taking the course as a requisite of either a nursing, medical, dental, physical therapy or pharmacy program. The results showed that in all three courses, students with significantly higher undergraduate GPA were more successful in the anatomy course (Eleazer 2018).

A retrospective analysis over 6 years with 300 medical students from Papua New Guinea showed that prior academic achievement as measured by GPA was clearly associated with successful and timely completion of the medical school (Tomdia-Lokes, 2020).

A study conducted at two separate universities in the USA with 1274 students enrolled in undergraduate anatomy courses for health & science students showed that successful students in each of the courses had significantly higher undergraduate GPAs than unsuccessful students (Eleazer, 2018).

Role of Undergraduate Biology

A ten-year survey of student attrition in a UK medical school found that the leavers lacked A level biology. A-levels are advanced level qualifications high school students in the UK aged 16 to 19 can elect to get. (Simpson, 1996)

In a study of 737 students at an osteopathic medical school in the US no statistically significant difference in medical school performance was found between those with science and those with nonscience undergraduate major degrees. However, the biological MCAT score, and the science undergraduate GPA were significantly correlated with the medical school year-1 and year-2 GPAs. The biological MCAT score had the highest correlation among all preadmission variables with COMLEX Level 1 performance (Dixon, 2012).

Information collected from 206 graduating students at an osteopathic medical school in the USA analysed their preadmission variables with their progress through medical school. The MCAT biological sciences score was positively correlated with first year and second year medical school GPA; COMLEX-USA Level 1 total score and scores in the basic sciences disciplines of physiology, pharmacology (but not anatomy); and COMLEX Level 2-Clinical Exam total score, and internal medicine discipline score. It was not a strong predictor of global academic performance (Agahi, 2017).

In a study of 596 first year medical students tracked over nine years in a medical school in the USA, it was found that the MCAT biological sciences score was positively correlated with the anatomy physiology and biochemistry scores on the NBME test (Meleca,1995).

Data was collected from 602 students enrolled in an undergraduate anatomy and physiology class as part of various life sciences degrees in the USA. The majors of these students were animal and poultry sciences, agricultural sciences, biochemistry, biological sciences, dairy science, and “other,” which combined all other majors. Biology majors had a final anatomy and physiology grade that was significantly higher than the grade of all other majors (Gwazdauskas, 2014).

Data from 107 students enrolled in an undergraduate Anatomy & Physiology course at a US college showed that the number of mathematics and science courses taken in high school was the most significant variable that correlated with final course grades (Harris, 2004).

In a study with 414 first year health science students in an Australian University studying anatomy and physiology, having completed a high school human biology course was correlated with higher course grades in the A&P class (Anderton, 2017).

Parents' Level of Education

In a study with 50 medical students in Turkey, the level of education of the mother had no effect on success in anatomy. However, the level of the father's education was negatively correlated with success in anatomy. The author explains the latter with the possibility that education does not correspond with economic status (Cigali, 2001).

A systematic review of studies published between 1996 and 2015 in Iran regarding medical students' academic success concludes that lower levels of parental education lead to underachievement. However, there is no quantification or elaboration regarding mothers' or fathers' educational status (Dolati, 2016).

A study with 675 medical students in Austria found no significant influence of either parents' education on students' academic success (Frischenchlager, 2005).

A 30-year retrospective study of over 2000 medical students in Croatia focused on 533 who were lost to attrition for various reasons. Among those 533 students maternal and paternal education was significantly correlated with medical school GPA (Kruzicevic 2012).

A study from Pakistan in a group of private colleges looked at the mothers' level of education and found that in this group of 300 students there was a significant positive correlation with exam scores (Hijazi, 2006).

Employment

Data from 107 students enrolled in an undergraduate Anatomy & Physiology course at a US college showed that there was a negative correlation between factors that reduce the time students have available for study, such as paid employment, and course grade in Anatomy & Physiology. (Harris, 2004)

In a study with 50 medical students in Turkey, students' employment was not found to make a difference on their anatomy success. However, the total study group was small and only very few of this already small study group was working. (Cigali, 2001).

Review

As can be seen from the above, the only variables that show a consistent pattern for predicting academic success in general and success in anatomy more specifically are prior academic achievement and achievement in a prior biology course.

While there are many studies suggesting female students perform better than their male peers, there are also a smaller number of studies that either find no difference or find the reverse to be true, i.e. males perform better than their female peers. Data regarding age is also mixed, however it might be that gender and age have a interaction that has not been adequately studied and is causing the inconsistent results.

Data regarding the effect of parents' level of education was also mixed. There was very little data that we found in out literature search regarding role of outside employment specific to our student group of interest.

CHAPTER III

Methodology

A survey was designed using the Survey Monkey software. It contained branched questions with advanced logic enabling the participant to advance through different question sets based on previous answers. The questions were closed-ended. The survey was initially sent to 5 students as a pilot. Based on their feedback some questions were edited and some were removed. Questionnaire completion time was an average of 7 minutes.

The survey was then sent via the students' online class platform (Google Classroom), to all the Turkish speaking dental students at the Cyprus Health and Social Sciences University who had completed at least 1 semester of face-to-face, in-classroom lectures. It was explained that the study was voluntary and as a completion incentive, participants were informed they would be able to see the collective anonymized results of their peers.
To maintain student privacy and anonymity no identifying data was collected and students were asked to self-report their grades.

Prior approval for the study was obtained from the Ethics Committee of Near East University.

Participants

Participants in the study were Turkish speaking dental students at the Cyprus Health and Social Sciences University (CHSSU) who had completed at least 1 semester of face-to-face, in-classroom lectures. Anatomy is taught over four semesters at CHSSU. Each semester has three hours per week of theoretical lectures and one hour per week of laboratory sessions. The first two semesters focuses on the body systems and the last two semesters focuses on head and neck anatomy

Information collected in the survey was the following:

Variables that may affect success:

Age; gender; country in which they attended high school; whether their high school was in a major city, town or village, their living arrangements during high school (whether they lived with their parents, in a dormitory, etc); their high school GPA; whether they took biology during high school; if they did take biology, what their biology GPA was; type of high school they graduated from; their mothers' education; their fathers' education; how much of the anatomy lectures they attended; whether they listened during lecture; whether they understood the anatomy lectures; how hard they thought anatomy was compared to the other subjects they were taking; whether they liked anatomy; whether they had an anatomy text book; whether they had an anatomy atlas; whether they studied by themselves or with friends; whether they used the lecture notes provided by their instructor; whether they had a job and if so how many hours they worked per week.

Outcomes used to assess levels of success:

Success in anatomy was measured as the final exam score for each semester the student took anatomy. For students who had to take a re-sit exam, we accounted their re-sit exam score as their final score. These students accounted for a very small proportion in each semester.

Data Analysis Plan

Success criteria for the purpose of this study were the anatomy final exam scores. Since students at CHSSU, School of Dentistry take anatomy courses for four semesters, we had four sets of data for the anatomy final exams. The anatomy score data within each semester did not follow normal distribution, therefore statistically we had to analyse each semester within itself rather than joining the data from all four semester to analyse as one group.

To begin with, descriptive statistics were completed on all the data. When comparing multiple categories for each variable, one way variance analysis (ANOVA) was used to assess for any differences. Where statistically differences were found, further analysis was done using Fisher's Least Significant Difference test to identify the specific categories and the level of the difference.

Pearson Correlation test was used to look for correlations between anatomy scores and the numeric values such as age, high school GPA and biology GPA. Student t-test was used to look for correlations with gender.

Data was extracted directly from the Survey Monkey software into SPSS file format for analysis.

CHAPTER IV

Findings:

The Anatomy Scores:

The anatomy scores from each semester are shown in Table 1.

Semester 1 (Sem 1 AS): First year, autumn semester, anatomy score

Semester 2 (Sem 2 AS): First year spring semester, anatomy score

Semester 3 (Sem 3 AS): Second year autumn semester, anatomy score

Semester 4 (Sem 4 AS): Second year spring semester, anatomy score

Table 1

Anatomy Scores by Semester

	N	Mean	SD	Median	%25	%75	Skew	Kurtosis
Sem 1 AS	140	72.16	17.35	74.5	62	85	-1.05	1.90
Sem 2 AS	96	74.08	12.47	74.5	65	85	-0.18	-0.68
Sem 3 AS	96	69.6	18.11	70	60	85	-0.70	0.73
Sem 4 AS	66	74.4	12.66	77.5	70	80	-0.64	0.74

Age:

Overall, out of a total of 140 respondents the youngest was age 18 and the oldest was 26, with the mean being 21. Age was skewed towards older students. (Table 2)

Table 2

Age Distribution of Students in Study Sample

Variable	N	Mean	SD	Median	%25	%75	Skew	Kurtosis
Age	140	22	1.99	21	20	22	2.63	10.82

There was a statistically significant correlation between age and anatomy scores only for Semester 3. It was a weak, negative correlation with a correlation coefficient (r) of -0.22 and a p value of 0.03. (Table 3)

Table 3

Correlation of Age with Anatomy Scores -Pearson Correlation

Age	r Value	p Value
Sem 4 AS	0.04	0.74
Sem 3 AS	-0.22	**0.03**
Sem 2 AS	-0.08	0.44
Sem 1 AS	0.01	0.85

See Appendix 2 for graphs showing age correlation with anatomy scores.

Gender

Out of a total of 140 respondents, overall, there were 57 males (40.43%), 83 females (58.87 %) and 1 person who identified as 'other' (0.71%).

There was a statistically significant correlation between gender and anatomy scores for all semesters except for semester 1, with females having a higher mean score.

For semester 4, the mean anatomy score for females was 77.1, whilst the mean for males was 68.9. (Table 4)

Table 4

Anatomy Scores by Gender in Semester 4

Sem 4 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
Female (A)	44	77.1	10.5	1.6	73.9	80.3
Male (B)	22	68.9	15	3.2	62.5	75.6
Diff (A - B) (t-Test)		8.2		3.2	1.9	14.6

For semester 4, this 8-point difference between genders was statistically significant with a p value of 0.01 and the t-score being 2.6. (Table 5)

Table 5

Student t-Test Analysis of Anatomy Scores by Gender in Semester 4

Variable	S.D.	Test statistic (t)	p value	Test Variance	Estimation
Diff (A - B)	64	2.6	0.01	0	8.2

In semester 3 females had a mean score of 72.77 while males had a mean score of 62.93. (Table 6)

Table 6

Anatomy Scores by Gender in Semester 3

Sem 3 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
Female (A)	66	72.77	16.1	1.98	68.7	76.7
Male (B)	30	62.9	20.6	3.8	55.2	70.6
Diff. (A - B) (t-Test)		9.8		3.9	2.06	17.5

The difference in anatomy scores of males and females in Semester 3 was a statistically significant difference of 9.8 with a t score of 2.5 and a p value of 0.01. (Table 7)

Table 7

Student t-Test Analysis of Anatomy Scores by Gender in Semester 3

Sem 3 AS	S.D.	Test statistic (t)	p value	Test Variance	Estimation
Diff (A - B)	94	2.5	0.01	0	9.8

In semester 2 the mean anatomy score of females was 75.95 while males had a mean score of 69.97. (Table 8)

Table 8

Anatomy Scores by Gender in Semester 2

Sem 2 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
Female (A)	66	75.95	12.37	1.52	72.91	78.99
Male (B)	30	69.98	11.88	2.17	65.53	74.40
Diff (A - B) (t-Test)		5.99		2.69	0.64	11.33

In semester 2 the statistically significant difference in anatomy scores between males and females was 6 points with a t-score of 2.22and p value of 0.03. (Table 9)

Table 9

Student t-Test Analysis of Anatomy Scores by Gender in Semester 2

Sem 2 AS	S.D.	Test statistic (t)	p value	Test Variance	Estimation
Diff (A - B)	94	2.23	0.03	0	5.99

In semester 1 the mean anatomy score of females was 73.15 while males had a mean score of 70.78. (Table 10)

Table 10

Anatomy Scores by Gender in Semester 1

Sem 1 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
Female (A)	82	73.15	15.67	1.73	69.70	76.59
Male (B)	58	70.78	19.55	2.57	65.64	75.91
Diff (A - B) (t-Test)		2.37		2.98	-3.52	8.27

For semester 1 there was no statistically significant difference between the anatomy scores of males and females.

Sem 1 AS	S.D.	Test statistic (t)	p value	Test Variance	Estimation
Diff (A - B)	138	0.7951	0.428	0	2.3705

Table 11

Student t-Test Analysis of Anatomy Scores by Gender in Semester 1

Sem 1 AS	S.D.	Test statistic (t)	p value	Test Variance	Estimation
Diff (A - B)	138	0.80	0.43	0	2.37

See Appendix 3 for graphs showing anatomy scores by gender in each semester.

High School GPA

Students provided their high school GPA on a 100-point scale as is the custom in Turkey and the Turkish Republic of Northern Cyprus. (Table 12)

Table 12

High School GPA and Anatomy Scores by Semester

	N	Mean	S.D	Median	%25	%75	Skew	Kurtosis
High School GPA	140	84.75	10.65	87	80	91	-2.74	16.31
Sem 4 AS	66	74.39	12.66	77.5	70	80	-0.64	0.74
Sem 3 AS	96	69.65	18.12	70	60	85	-0.70	0.73
Sem 2 AS	96	74.08	12.47	74.5	65	85	-0.18	-0.69
Sem 1 AS	140	72.16	17.35	74.5	62	85	-1.05	1.91

The only statistically significant correlation found between high school GPA and anatomy scores was in semester 1. This was a statistically significant weak positive correlation with an r value of 0.29 and p value < 0.001. (Table 13)

Table 13

Correlation of High School GPA with Anatomy Scores by Semester - Pearson Correlation

High School GPA	r Value	p Value
Sem 4 AS	- 0.05	0.72
Sem 3 AS	0.06	0.55
Sem 2 AS	- 0.13	0.21
Sem 1 AS	0.29	**<0.001**

Having Studied Biology in High School

Students were asked whether they had studied biology in high school. The overwhelming majority had – only 5 students out of the 141 had not. Therefore, this did not become a variable for analysis.

High School Biology Score

The high school biology scores for the study population are shown in Table 14.

Table 14

High School Biology Scores

N	Mean	Median
134	85.2	85.00

The only statistically significant correlation between high school biology score and anatomy score was in Semester 4. It was a weak positive correlation of 0.24 with a p value of 0.05. (Table 15)

Table 15

High School Biology Scores Correlation with Anatomy Scores - Pearson Correlation

Biology Score	r Value	p Value	N
Sem 4 AS	0.24	0.05	64
Sem 3 AS	0.14	0.18	93
Sem 2 AS	-0.12	0.89	93
Sem 1 AS	0.10	0.27	134

Mother's Education

Highest level of education that the students' mother completed was asked. Overall results are shown in Table 16.

Table 16

Mother's Education

Mother – Highest Level of Education	N	%
PhD & equivalent	5	3.55
Masters	4	2.84
University	40	28.37
High School	42	29.79
Vocational School	8	5.67
Secondary School	16	11.35
Primary School	23	16.31
None	3	2.13

Due to total sample size restrictions on analysis, the results were grouped from the eight distinct categories of education into four categories of education as shown in Table 17.

Table 17

Mother's Education – Reduced & Re-grouped Categories

Mother – Highest Level of Education	N	%
MSc + PhD	9	6.39
University	40	28.37
High School + Vocational School	50	35.46
Secondary Sch + Primary Sch + None	42	29.79

The reduced and re-grouped category data was then analysed per semester as to whether educational status of the mother made a difference on the anatomy score achieved. ANOVA analysis did not find any statistically meaningful difference between any of the educational categories of the mother and anatomy scores for any of the four semesters. (Tables 18 – 25)

Table 18

Mother's Education and Semester 4 Anatomy Scores

Sem 4 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	4	74.5	5.26	2.63	66.13	82.87
University	18	73.56	13.13	3.10	67.02	80.09
High School + Vocational School	27	75.15	12.99	2.50	70.01	80.29
Secondary Sch + Primary Sch + None	17	74.06	13.66	3.31	67.04	81.08

There was no statistically meaningful difference between the educational categories of the mother and anatomy scores for Semester 4. (Table 19)

Table 19

Mother's Education and Semester 4 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
Mothers' Ed	3	29.96	9.99	0.06	0.98
Residuals	62	10393.79	167.64		
Sum	65	10423.76			

Table 20

Mother's Education and Semester 3 Anatomy Scores

Sem 3 AS Mother's Ed	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	7	77.57	16.66	6.30	62.16	92.98
University	29	64.59	20.90	3.88	56.64	72.54
High School + Vocational School	39	69.23	18.00	2.88	63.39	75.07
Secondary Sch + Primary Sch + None	21	74.76	12.70	2.77	68.98	80.54

There was no statistically meaningful difference between the educational categories of the mother and anatomy scores for Semester 3. (Table 21)

Table 21

Mother's Education and Semester 3 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
	3	1738.48	579.49	1.81	0.15
Residuals	92	29439.48	319.99		
Sum	95	31177.96			

Table 22

Mother's Education and Semester 2 Anatomy Scores

Sem 2 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	7	81	10.55	3.99	71.24	90.76
University	29	69.34	10.32	1.92	65.42	73.27
High School + Vocational School	39	76.13	13.25	2.12	71.83	80.42
Secondary Sch + Primary Sch + None	21	74.52	12.87	2.81	68.67	80.38

There was no statistically meaningful difference between the educational categories of the mother and anatomy scores for Semester 2. (Table 23)

Table 23

Mother's Education and Semester 2 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
	3	1153.18	384.39	2.59	0.06
Residuals	92	13628.15	148.13		
Sum	95	14781.33			

Table 24

Mother's Education and Semester 1 Anatomy Scores

Sem 1 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	9	76.56	14.31	4.77	65.56	87.56
University	39	70.92	18.39	2.94	64.96	76.88
High School + Vocational School	50	69.52	20.00	2.83	63.84	75.20
Secondary Sch + Primary Sch + None	42	75.5238	12.80	1.97	71.53	79.51

There was no statistically meaningful difference between the educational categories of the mother and anatomy scores for Semester 1. (Table 25)

Table 25

Mother's Education and Semester 1 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
	3	1057.27	352.42	1.17	0.32
Residuals	136	40807.95	300.06		
Sum	139	41865.22			

Graphic representation for anatomy scores grouped by mother's education for each semester is shown in Appendix 4.

Father's Education

Highest level of education that the students' father completed was asked. Overall results are shown in Table 26.

Table 26

Father's Highest Level of Education

Father – Highest Level of Education	N	%
PhD & equivalent	6	4.26
Masters	13	9.22
University	41	29.08
High School	35	29.82
Vocational School	7	4.96
Secondary School	18	12.77
Primary School	20	14.18
None	1	0.71

As with mothers' education, due to total sample size restrictions on analysis, the results were re-grouped in the same way, from the eight distinct categories of education into four categories of education as shown in Table 27.

Table 27

Father's Education – Reduced & Re-grouped Categories

Father – Highest Level of Education	N	%
MSc + PhD	19	13.48
University	41	29.08
High School + Vocational School	42	34.78
Secondary Sch + Primary Sch + None	39	27.66

This data was then analysed per semester as to whether educational status of the father made a difference on the anatomy score achieved. (Tables 28 – 36)

ANOVA analysis found a statistically meaningful difference between the educational categories for the father and anatomy scores with a p value of 0.039, for semester one only. (Table 28 and 29)

Table 28

Father's Education and Semester 1 Anatomy Scores

Sem 1 AS	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	18	80.5	11.23	2.65	74.91	86.09
University	41	71.80	14.40	2.25	67.26	76.35
High School + Vocational School	42	67.09	21.56	3.33	60.38	73.81
Secondary Sch + Primary Sch + None	39	74.15	16.13	2.58	68.92	79.38

Table 29

Father's Education and Semester 1 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	Test Statistics (F)	P Value
Fathers' Ed Sem 1	3	2489.59	829.86	2.87	0.039
Residuals	136	39375.64	289.53		
Sum	139	41865.22			

A follow-up (ad-hoc) analysis for Semester 1 using Fisher's LSD test comparing each category against the other showed that a 13-point difference was originating from the difference between the categories of [high school plus vocational school] and [MSc + PhD], with a p value of 0.006. (Table 30). The mean for the former group was 67 whereas the mean for the latter group was 80.

Table 30

Father's Education and Semester 1 Inter-group Comparisons for Anatomy Scores - Fisher LSD

Comparison Fathers' Ed Semester 1	Estimate	P Value
UNIVERSITY --- MSc+PhD	-8.67	0.07
HIGH SCHOOL + VOCATIONAL SCHOOL --- MSc+PhD	-13.40	**0.006**
SECONDARY SCH + PRIMARY SCH + NONE --- MSc+PhD	-6.35	0.19
HIGH SCHOOL + VOCATIONAL SCHOOL --- UNIVERSITY	-4.71	0.21
SECONDARY SCH + PRIMARY SCH + NONE --- UNIVERSITY	2.34	0.54
SECONDARY SCH + PRIMARY SCH + NONE - HIGH SCHOOL + VOCATIONAL SCHOOL	7.06	0.06

Table 31

Father's Education and Semester 2 Anatomy Scores

	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	14	73.64	14.78	3.95	65.11	82.18
University	31	73.3548	11.01	1.9781	69.32	77.39
High School + Vocational School	25	75.28	14.11	2.8228	69.45	81.11
Secondary Sch + Primary Sch + None	26	74.0385	11.78	2.3095	69.28	78.80

Table 32

Father's Education and Semester 2 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	P Value
	3	55.02	18.34	0.11	0.95
Residuals	92	14726.31	160.07		
Sum	95	14781.33			

Table 33

Father's Education and Semester 3 Anatomy Scores

	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	14	65	20.60	5.51	53.11	76.89
University	31	66.81	20.74	3.72	59.20	74.41
High School + Vocational School	25	71.60	17.44	3.49	64.40	78.80
Secondary Sch + Primary Sch + None	26	73.65	13.26	2.60	68.30	79.01

Table 34

Father's Education and Semester 3 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	P Value
	3	1065.23	355.08	1.08	0.36
Residuals	92	30112.72	327.31		
Sum	95	31177.96			

Table 35

Father's Education and Semester 4 Anatomy Scores

	N	Mean	S.D.	S.E.M.	Mean (Lowest)	Mean (Highest)
MSc + PhD	10	76	9.64	3.05	69.11	82.89
University	18	75.17	14.58	3.44	67.92	82.42
High School + Vocational School	17	72.47	12.52	3.04	66.03	78.91
Secondary Sch + Primary Sch + None	21	74.52	12.97	2.83	68.62	80.43

Table 36

Father's Education and Semester 4 Anatomy Scores - ANOVA

	S.D.	Sum of Squares	Mean of Squares	Test Statistics (F)	P Value
	3	99.78	33.26	0.20	0.90
Residuals	62	10323.97	166.52		
Sum	65	10423.76			

Having an Anatomy Textbook

Students were asked whether they had a physical or electronic anatomy textbook. Approximately half of them did, although the percentage was different per semester. The results are shown in Table 37.

Table 37

Whether Had an Anatomy Textbook – t-Test

	Has Textbook	N	Mean	S.D.	S.E.M.	t value	P value
Sem 4 AS	Yes	32	77.63	12.02	2.12	2.08	**0.04**
	No	32	71.13	12.98	2.29		
Sem 3 AS	Yes	50	70.86	17.22	2.44	0.61	0.54
	No	44	68.55	19.40	2.92		
Sem 2 AS	Yes	50	73.42	11.61	1.64	0.60	0.55
	No	44	74.98	13.71	2.07		
Sem 1 AS	Yes	57	69.02	15.62	2.07	1.81	0.07
	No	80	74.44	18.38	2.05		

There was a statistically significant difference in anatomy scores between students who had an anatomy textbook and those who did not, in semester 4 only.

In semester 4, students who had an anatomy textbook had a mean score of 77.6 while students who did not had a mean anatomy score of 71.1. The p value was 0.04. (Table 37)

Having an Anatomy Atlas

Students were asked whether they had an anatomy atlas, either physical or electronic. Results are shown in Table 38.

There was no statistically significant difference in anatomy scores between students who had an anatomy atlas and those who did not, in any of the semesters.

Table 38

Whether Had an Anatomy Atlas t- Test

	Has Atlas	N	Mean	S.D.	S.E.M.	t value	p value
Sem 4 AS	Yes	51	74.20	12.53	1.76	0.22	0.83
	No	13	75.08	14.47	4.01		
Sem 3 AS	Yes	66	68.55	19.23	2.37	1.07	0.32
	No	28	72.68	15.48	2.93		
Sem 2 AS	Yes	66	74.53	11.68	1.44	0.45	0.66
	No	28	73.25	14.72	2.78		
Sem 1 AS	Yes	80	73.46	14.19	1.59	1.02	0.31
	No	57	70.39	21.15	2.80		

Attending Anatomy Lectures

Students were asked whether they attended anatomy lectures. The overwhelming majority of students attended all or most of the lectures. (Table 39) Therefore, the numbers did not allow a meaningful statistical analysis for lecture attendance as a variable for anatomy exam scores.

Table 39

Anatomy Lecture Attendance

Anatomy Lecture Attendance	N
Attended almost all lectures	100
Attended most lectures	36
Attended about half of the lectures	3
Mostly did not attend lectures	2

Listening to Anatomy Lectures

Students were asked to what extent they listened to the anatomy lectures they took. The extent of listening was grouped as (1) listened to entire lecture (2) mostly listened (3) sometimes listened and sometimes did not (4) never listened. There were very few students in group 4, therefore groups 3 and 4 were joined.

There was a statistically significant difference in anatomy scores between groups who had different levels of listening for Semester 1 only.

Table 40 shows the anatomy scores for Semester 1, grouped according to levels of listening.

Table 40

Semester 1, Listening to Anatomy Lectures and Anatomy Scores

Listening to Lectures Sem 1	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Listened to entire lecture	26	77.85	14.46	2.84	72.01	83.69
Mostly listened	72	73.51	14.85	1.75	70.02	77.00
Sometimes listened & sometimes did not + Never listened	42	66.33	21.29	3.29	59.70	73.00

There was a statistically significant difference in anatomy scores in Semester 1 between groups who had different levels of listening. (Table 41)

Table 41

Semester 1, Listening to Anatomy Lectures and Anatomy Scores - ANOVA

Sem 1	S.D.	Sum of Squares	Mean of Squares	Test Statistic (F)	p Value
Listening to Lectures	2	2398.52	1199.26	4.16	**0.018**
Residuals	137	39466.70	288.08		
Total	139	41865.22			

A further analysis to determine the source of this difference in semester 1 using the Fisher LSD test showed that there was a statistically significant difference of an estimated 11.51 marks in anatomy scores between the groups who [sometimes listened & sometimes did not + never listened] and the group who listened to entire lectures with a p value of 0.007. There was also a statistically significant difference of an estimated 7.18 marks in anatomy scores between the groups who [sometimes listened & sometimes did not + never listened] and those who mostly listened, with a p value of 0.03. (Table 42)

Table 42

Semester 1, Listening to Anatomy Lectures and Anatomy Scores - Fisher LSD Test

Comparison	Estimate	p Value
Mostly listened - Listened to entire lecture	-4.33	0.27
Sometimes listened & sometimes did not + Never listened - Listened to entire lecture	-11.51	0.007
Sometimes listened & sometimes did not + Never listened - Mostly listened	-7.18	0.03

Table 43 shows the anatomy scores for Semester 1, grouped according to levels of listening.

Table 43

Semester 2, Listening to Anatomy Lectures and Anatomy Scores

Listening to Lectures Sem 2	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Listened to entire lecture	18	76.61	11.09	2.61	71.10	82.13
Mostly listened	51	75.22	11.01	1.54	72.12	78.31
Sometimes listened & sometimes did not + Never listened	27	70.26	15.26	2.94	64.22	76.30

There were no meaningful differences between the anatomy scores of students with different levels of listening in Semester 2. (Table 44)

Table 44

Semester 2, Listening to Anatomy Lectures and Anatomy Scores - ANOVA

Listening to Lectures Sem 2	S.D.	Sum of Squares	Mean of Squares	Test Statistic (F)	p Value
Listening to Lectures	2	575.24	287.62	1.88	0.16
Residuals	93	14206.09	152.75		
Total	95	14781.33			

Table 45 shows the anatomy scores for Semester 3, grouped according to levels of listening.

Table 45

Semester 3, Listening to Anatomy Lectures and Anatomy Scores

Listening to Lectures Sem 3	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Listened to entire lecture	18	77.39	12.05	2.84	71.39	83.38
Mostly listened	51	69.39	18.46	2.56	64.1993	74.59
Sometimes listened & sometimes did not + Never listened	27	64.96	19.60	3.77	57.21	72.72

There were no statistically significant differences between the anatomy scores of students with different levels of listening in Semester 3. (Table 46)

Table 46

Semester 3, Listening to Anatomy Lectures and Anatomy Scores – ANOVA

Listening to Lectures Sem 3	S.D.	Sum of Squares	Mean of Squares	Test Statistic (F)	p Value
	2	1674.56	837.28	2.64	0.08
Residuals	93	29503.40	317.24		
Total	95	31177.96			

Table 47 shows the anatomy scores for Semester 4, grouped according to levels of listening.

Table 47

Semester 4, Listening to Anatomy Lectures and Anatomy Scores

Listening to Lectures Sem 4	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Listened to entire lecture	11	78.91	11.92	3.59	70.90	86.92
Mostly listened	35	74.51	14.40	2.43	69.57	79.46
Sometimes listened & sometimes did not + Never listened	20	71.70	9.11	2.04	67.43	75.97

There were no statistically significant differences between the anatomy scores of students with different levels of listening in Semester 4 (Table 48).

Table 48

Semester 4, Listening to Anatomy Lectures and Anatomy Scores – ANOVA

Listening to Lectures Sem 3	S.D.	Sum of Squares	Mean of Squares	Test Statistic (F)	p Value
	2	369.91	184.95	1.16	0.32
Residuals	63	10053.85	159.56		
Total	65	10423.76			

Charts showing the anatomy scores for each semester according to level of listening are in given Appendix 6.

Perception of Difficulty of Anatomy versus Other Subjects

Student were asked whether they thought anatomy was difficult, the same level of difficulty as the other subjects in their dental curriculum, or not difficult at all. Results are shown in Table 49.

Table 49

How Do You Feel the Level of Difficulty of Anatomy Is?

	N	%
Very difficult	58	48.94
Same level of difficulty as other subjects	69	41.13
Not difficult	14	9.93

For each category of difficulty perception, anatomy scores in each semester were analysed for differences. In all semesters except in semester 4 we found a statistically significant difference in anatomy scores between groups based on their perception of difficulty of anatomy (Tables 50 – 60).

Table 50

Anatomy Scores and Level of Difficulty Perception – Semester 1

Sem 1	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Very difficult	58	65.90	19.60	2.57	60.74	71.05
Same level of difficulty as other subjects	69	75.55	14.47	1.74	72.08	79.03
Not difficult	13	82.15	10.63	2.95	75.73	88.58

In Semester 1 there was a statistically significant difference ($p < 0.001$) in anatomy scores between student groups with differing perceptions of difficulty of anatomy (Table 51).

Table 51

Anatomy Scores and Level of Difficulty Perception – Semester 1 - ANOVA

Sem 1	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
Level of Difficulty	2	4367.08	2183.54	7.98	**<0.001**
Residuals	137	37498.14	273.71		
Sum	139	41865.22			

This difference in Semester 1 anatomy scores between groups was an estimated 9.65 points between students who felt that anatomy had the same level of difficulty as other subjects and students who felt anatomy was very difficult (p = 0.001). Also there was an estimated 16.26 points difference in anatomy grades between students who felt anatomy was not difficult and those who thought it was very difficult (p = 0.002). (Table 52)

Table 52

Anatomy Scores and Level of Difficulty Perception – Semester 1 - Fisher LSD

Comparison - Sem 1	Estimate	p Value
Same level of difficulty as other subjects - Very difficult	9.65	**0.001**
Not difficult - Very difficult	16.26	**0.002**
Not difficult - Same level of difficulty as other subjects	6.6031	0.189

Table 53

Anatomy Scores and Level of Difficulty Perception – Semester 2

Sem 2	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Very difficult	33	68.91	12.49	2.17	64.48	73.34
Same level of difficulty as other subjects	53	76.02	12.00	1.65	72.71	79.33
Not difficult	10	80.90	9.15	2.89	74.36	87.44

In Semester 2 there was a statistically significant difference ($p < 0.006$) in anatomy scores between student groups with differing perceptions of difficulty of anatomy. (Table 54)

Table 54

Anatomy Scores and Level of Difficulty Perception – Semester 2 - ANOVA

Sem 2	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
Level of Difficulty	2	1546.72	773.36	5.43	**0.006**
Residuals	93	13234.61	142.31		
Sum	95	14781.33			

This difference in Semester 2 anatomy scores between groups was an estimated 7 points between students who felt that anatomy had the same level of difficulty as other subjects and students who felt anatomy was very difficult ($p = 0.009$). There was also an estimated 12 points difference in anatomy grades between students who felt anatomy was not difficult and those who thought it was very difficult ($p = 0.006$). (Table 55)

Table 55

Anatomy Scores and Level of Difficulty Perception – Semester 2 - Fisher LSD

Comparison – Sem 2	Estimate	p Value
Same level of difficulty as other subjects - Very difficult	7.11	**0.009**
Not difficult - Very difficult	12.00	**0.006**
Not difficult - Same level of difficulty as other subjects	4.89	0.238

Table 56

Anatomy Scores and Level of Difficulty Perception – Semester 3

Sem 3	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Very difficult	33	61.33	14.88	2.59	56.06	66.61
Same level of difficulty as other subjects	53	72.47	19.11	2.62	67.21	77.74
Not difficult	10	82.1	9.75	3.08	75.13	89.07

In Semester 3 there was a statistically significant difference ($p = 0.001$) in anatomy scores between student groups with differing perceptions of difficulty of anatomy. (Table 57)

Table 57

Anatomy Scores and Level of Difficulty Perception – Semester 3 - ANOVA

Sem 3	S.D.	Sum of Squares	Mean of Squares	Test Statistic (F)	p Value
Level of difficulty	2	4254.52	2127.26	7.35	**0.001**
Residuals	93	26923.44	289.50		
Sum	95	31177.96			

This difference in Semester 3 anatomy scores between groups was an estimated 11 points for anatomy scores between students who felt that anatomy had the same level of difficulty as other subjects and students who felt anatomy was very difficult (p = 0.004). There was also an estimated 20.77 points difference in anatomy grades between students who felt anatomy was not difficult and those who thought it was very difficult (p = 0.001). (Table 58)

Table 58

Anatomy Scores and Level of Difficulty Perception – Semester 3 - Fisher LSD

Comparison – Sem 3	Estimate	p Value
Same level of difficulty as other subjects - Very difficult	11.14	**0.004**
Not difficult - Very difficult	20.77	**0.001**
Not difficult - Same level of difficulty as other subjects	9.63	0.104

Table 59

Anatomy Scores and Level of Difficulty Perception – Semester 4

Sem 4	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Very difficult	26	70.5	13.20	2.59	65.1669	75.83
Same level of difficulty as other subjects	33	76.30	11.91	2.07	72.0809	80.53
Not difficult	7	79.86	11.58	4.38	69.1456	90.57

In Semester 4 there was no statistically significant difference in anatomy scores between student groups with differing perceptions of difficulty of anatomy. (Table 60)

Table 60

Anatomy Scores and Level of Difficulty Perception – Semester 4 - ANOVA

Sem 4	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
	2	723.43	361.72	2.35	0.10
Residuals	63	9700.33	153.97		
Sum	65	10423.76			

Charts showing anatomy scores for each semester according to perception of difficulty are in Appendix 7.

Liking or Not Liking Anatomy

Students were asked whether they liked or did not like anatomy or whether they were neutral. Results are shown in Table 61.

Table 61

Like/Neutral/Do Not Like Anatomy

	N	**%**
Like	77	54.61
Neutral	54	38.30
Do Not Like	10	7.09

Student anatomy scores per semester according to their like/dislike of anatomy and the analysis of differences is as follows. There was a statistically significant difference in anatomy scores between groups for Semester 3 only.

For semester 1 there was no statistically significant difference between anatomy scores depending on whether a student liked or did not like anatomy. (Tables 62 – 63)

Table 62

Like Anatomy and Anatomy Scores– Semester 1

Sem 1 AS	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Like	76	75.09	16.07	1.84	71.42	78.76
Neutral	54	68.65	19.08	2.60	63.44	73.86
Do Not Like	10	68.9	14.07	4.45	58.83	78.97

Table 63

Like Anatomy and Anatomy Scores – Semester 1- ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
	2	1425.65	712.83	2.41	0.09
Residuals	137	40439.57	295.18		
Sum	139	41865.22			

For semester 2 there was no statistically significant difference between anatomy scores depending on whether a student liked or did not like anatomy. (Tables 64 – 65)

Table 64

Like Anatomy and Anatomy Scores – Semester 2

	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Like	54	76.30	11.12	1.51	73.26	79.33
Neutral	33	71.45	13.80	2.40	66.56	76.35
Do Not Like	9	70.44	13.76	4.59	59.87	81.02

Table 65

Like Anatomy and Anatomy Scores – Semester 2- ANOVA

	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
	2	611.67	305.84	2.01	0.140
Residuals	93	14169.66	152.362		
Sum	95	14781.33			

For semester 3 there was a statistically significant difference ($p < 0.001$) between anatomy scores depending on whether a student liked or disliked anatomy. (Tables 66– 67)

Table 66

Like Anatomy and Anatomy Scores – Semester 3

	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Like	54	75.22	14.53	1.98	71.26	79.19
Neutral	33	64.91	20.58	3.58	57.61	72.21
Do Not Like	9	53.56	14.54	4.85	42.38	64.73

Table 67

Like Anatomy and Anatomy Scores – Semester 3- ANOVA

Sem 3	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
Like/Dislike/Neutral	2	4749.68	2374.84	8.36	**<0.001**
Residuals	93	26428.28	284.18		
Sum	95	31177.96			

In semester 3, students who liked anatomy had a statistically significant difference of an estimated 10.31 points higher in anatomy scores than students who were neutral ($p = 0.007$). Also, students who liked anatomy had a statistically significant difference of an estimated 21.67 points higher in anatomy grades than students who did not like anatomy ($p < 0.001$). (Table 68)

Table 68

Like Anatomy and Anatomy Scores – Semester 3- Fisher LSD

Comparison - Sem 3	Estimate	p Value
Neutral - Like	-10.31	**0.007**
Dislike - Like	-21.67	**<0.001**
Dislike - Neutral	-11.35	0.077

For semester 4 there was no statistically significant difference between anatomy scores depending on whether a student liked or did not like anatomy. (Tables 69 – 70)

Table 69

Like Anatomy and Anatomy Scores – Semester 4

	N	Mean	S.D.	S.E.M.	Mean (Low)	Mean (High)
Like	32	74.78	13.85	2.45	69.79	79.78
Neutral	25	75.32	11.39	2.28	70.62	80.02
Do Not Like	9	70.44	12.21	4.07	61.06	79.83

Table 70

Like Anatomy and Anatomy Scores – Semester 4- ANOVA

Sem 4	S.D.	Sum of Squares	Mean of Squares	F Test	p Value
Like/Dislike/Neutral	2	166.63	83.31	0.51	0.602
Residuals	63	10257.13	162.81		
Sum	65	10423.76			

Charts showing anatomy scores for each semester according to perception of difficulty are in Appendix 8.

Having a Job

Students were asked whether they had a job, i.e., were working and if yes, how many hours per week. In total there were 32 students who had ever worked in any given semester. In each semester there were between 7 to 9 students who worked. Their hours ranged from less than 4 hours a week to more than 20 hours a week. (Table 70) Given the small subject number and wide spread of range of hours worked, we were not able to analyse this data with regards to its influence on anatomy exam scores.

Table 71

Students Who Worked: How Many Hours Per Week

Hours Worked	Sem 4 - N	Sem 3 - N	Sem 2 - N	Sem 1 - N
0 - 5	4	2	3	3
6 - 10	1	1	2	4
11 - 15	2	1	2	1
16 - 20	0	1	0	0
> 21	2	2	1	1
Cumulative Frequency	9	7	9	9

CHAPTER V

Discussion

Gender Differences

The role of gender on success in all realms of life has fascinated intellectuals for decades. It is also perhaps the most researched variable related to academic success. While a significant body of data shows female gender to have an advantage in fields like medicine and dentistry, there are also conflicting data. There are several studies that find no affect at all (Eleazer 2018, Puddey, 2014, Sitticharoon, 2014, Tomdia-Lokes 2020) and there are studies that report the reverse. Coy et al. report that males perform significantly better on the Perceptual Ability Test (PAT) part of the dental school admissions test in the USA (Coy, K., 2003). Frischenschlager et al. (2006) report that males perform significantly better than females in medical school in Austria (Frischenschlager et al.,2006).

In this study we found a statistically significant correlation between gender and anatomy scores for all semesters except for semester 1, with females having a higher mean score. In semester 4, it was an 8-point difference. In Semester 3 it was a 9.8 points difference. In semester 2 it was a 6-point. Given that the statistically significant differences between males are females ranged between 6 and (almost) 10 in the three semesters we analysed, it is curious that none was detected in the other semester. Whether the (non-statistically significant) difference of 2.37 points would have been greater and become statistically significant for semester 1, had our sample size been larger is an open question.

Prior Academic Achievement

Traditionally, the predictors for academic success in medical school have been factors resulting from prior academic achievement, such as high school total GPA, high school or undergraduate biology and other science courses GPA and in the USA, the MCAT, or the equivalent tests for other countries. In our study we found a statistically significant correlation between high school GPA and anatomy scores only in semester 1 and even then, this was only a weak positive correlation. The statistically significant correlation we found between high school biology score

and anatomy score was again, only in one semester, namely in Semester 4. It was a weak positive correlation. We did not ask the students in our survey about their Turkish university entrance exam score (ÖSYM exam).

In our study sample there were students who had enrolled in CHSSU from Turkey and had been admitted via the ÖSYM exam (54%), students who were from the TRNC and had enrolled without an entrance exam (33%) and students who were of Turkish origin but had had their primary and secondary education from a third country, mostly Germany (13%). The group from Turkey having been subjected to a selection process such as the ÖSYM exam with the other two groups not being subjected to any selection process at all, makes for a potential confounding factor in evaluating this factor in a sample size small as ours. It is possible that this is also a reason we did not find correlations in anatomy scores across all 4 semesters with high school GPA and biology GPA

Ideally, with a larger study sample, these parameters could be compared in each student group (from Turkey, from TRNC and other) to see whether the correlations are different in each.

Age

The pattern emerging from studies looking at university level academic success is that it is inversely correlated with age. In our study we found a statistically significant weak, negative correlation only for Semester 3. It should be noted that our study sample was highly skewed towards older age, and this would affect the statistical outcome.

The reason for older students to perform less well than their younger peers may be due to time elapsed between graduating high school and enrolling in university, hence having 'forgotten' how to study and learn. It may also be because they have more responsibilities and therefore less time to dedicate to their studies. It would be worthwhile to analyse the effect of age on success by controlling for factors such as whether the student has been continuously enrolled in some type of academic pursuit since graduating high school or whether there has been a gap; and also by controlling for factors such as work outside the university or other outside responsibilities that

may arise with increasing age. It is also highly likely that age by gender interaction would show differences.

Parental Level of Education

Some of the published literature on effect of parents' level of education suggests that higher levels in general correlate with higher achievement while some studies find no affect. It could be presumed that parental education may affect the student in various ways such as the level of motivation and possibly the financial and social resources available to them for academic studies. It could also be assumed that the city and country of residence would interact with these parameters in that living on a small and insular island such as the TRNC, readily available resources and opportunities would be circumscribed regardless of parental education. 33% of our study sample was from the TRNC.

In our study we did not find any statistically meaningful difference between the educational categories of the mother and anatomy scores for any semester. To note, only 6% of mothers in our study has graduate level of education and 28% had college/university level education. Whether having had a larger percentage of mothers with graduate level education would have shown more differences is an open question.

We found a statistically meaningful difference between the educational categories for the father and anatomy scores for semester one only (Table 28 and 29). This was a 13-point difference between the categories of [high school plus vocational school] and [MSc + PhD] (Table 30). The mean for the former group was 67 whereas the mean for the latter group was 80. That such a difference merged only in one semester raises questions about the validity of this result. The fathers in our study population differed slightly from the mothers in that there were more graduates. 13% of fathers in our study had graduate level of education and 29% had college/university level education.

Having an Anatomy Textbook and/or Atlas

We found a statistically significant difference in anatomy scores between students who had an anatomy textbook, whether hardcopy or electronic and those who did not, in semester 4 only. There was no statistically significant difference in anatomy scores between students who had an anatomy atlas, again whether hardcopy or electronic, and those who did not, in any of the semesters. It could be presumed that having a textbook and/or atlas shows commitment and motivation. On the other hand, there are a plethora of free online resources that students can use for studying, not to mention the lecture notes of the instructor. As such, it is hard to draw any inferences from our findings.

Attitude Towards Anatomy – Listening/Liking/Level of Difficulty

We found a statistically significant difference in anatomy scores between groups who had different levels of listening for Semester 1 only. This was an estimated 11.51 marks between the groups who [sometimes listened & sometimes did not + never listened] and the group who listened to entire lectures. There was also a statistically significant difference of an estimated 7.18 marks in anatomy scores between the groups who [sometimes listened & sometimes did not + never listened] and those who mostly listened (Table 42). Given that this difference was found only in one semester, the real effect is either very small or does not exist at all.

We found a difference between groups of students based on their liking or not liking only in Semester 3. Those who liked anatomy had a statistically significant difference of an estimated 10.31 points higher in anatomy scores than students who were neutral. Also, students who liked anatomy had a statistically significant difference of an estimated 21.67 points higher in anatomy grades than students who did not like anatomy (Table 68). Given that this difference was found only in one semester, the real effect is either very small or does not exist at all.

For both the effect of level of listening and liking, it is curious that even though the difference appears only in one semester, it is quite a marked one

We found a statistically significant difference in all semesters except in semester 4 in anatomy scores between groups based on their perception of difficulty of anatomy (Tables 50 – 60). This difference in Semester 1 anatomy scores between groups was an estimated 9.65 points between students who felt that anatomy had the same level of difficulty as other subjects and students who felt anatomy was very difficult. Also, there was an estimated 16.26 points difference in anatomy grades between students who felt anatomy was not difficult and those who thought it was very difficult (Table 52). In Semester 2, the difference was an estimated 7 points between students who felt that anatomy had the same level of difficulty as other subjects and students who felt anatomy was very difficult. There was also an estimated 12 points difference in anatomy grades between students who felt anatomy was not difficult and those who thought it was very difficult. (Table 55). In Semester 3, the difference was an estimated 11.14 points between students who felt that anatomy had the same level of difficulty as other subjects and students who felt anatomy was very difficult. There was also an estimated 20.77 points difference in anatomy grades between students who felt anatomy was not difficult and those who thought it was very difficult. (Table 58).

These results suggest that the perception of level of difficult is an important factor in learning and succeeding in anatomy. It lends itself for instructors to consider and focus on various techniques to enhance the perception of anatomy as ‘approachable’, ‘understandable’ and ‘not difficult’.

CHAPTER VI

Conclusions and Recommendations

Of all the finding in this study, the differences and correlations that were the clearest and most indicative of a pattern were those for gender and for how difficult the student perceives anatomy to be. While gender is a non-variable parameter, the perception of difficulty of a subject is highly variable and very much subject to students' past experiences as well as the instructors' teaching methods, the classroom environment and instructional tools used.

It is of utmost importance that we can help students understand the role of anatomy as learning about the normal structure of the body being pivotal to enable understanding of *how* it works; that anatomy is not a set of difficult to memorize Latin terminology and a burden to get through; that memorization of structures without understanding three dimensional and functional relationships will not result in and is not the same as real learning; that being able to compare and analyse information and structures will allow them to solidify their understand and result in (at least) a base level of knowledge that they can draw from and importantly 'use' as needed for the rest of their health-care careers. Perhaps this is not as easy a goal as it seems, especially if students do not come from an educational background that emphasises critical thinking, analysis, and the ability to integrate information – most likely a rarely found educational environment in third world countries such as where we have conducted our study.

Instructors and schools should be open to finding ways to make anatomy easier and more pleasant to understand for students, encourage them to first understand and then constantly compare and analyse, to burn images in three dimensions into their 'mind's eye'. This will no doubt result in better academic outcomes. It will remain a personal challenge and priority for this author as she continues her academic career.

Recommendations for Further Research

There were several limitations to our study. First, our study sample was relatively small, hence not allowing possible differences to be detected. Second the criteria by which students were admitted to the school was different within the study sample as elaborated above (students from Turkey vs students from the TRNS, vs students from a third country). Third, it was conducted at a single institution, thus limiting generalizability.

The demographics of the students were skewed to older age. Having a larger study sample would allow younger students to be better represented and account for findings. Factors such as parental education were also not normally distributed. Having a larger sample size would have allowed the parental groups with higher education to be represented. There were very few students who worked, and a bigger sample size would have also allowed for them to be represented and the effects analysed. It would also be interesting to see whether differences we found only in certain semesters would spread to all semesters or disappear altogether with a larger sample size. Having a larger sample size would also allow us to analyse for the influence of gender by age interaction. It would allow us to see differences in student populations who enrol in dental school via the selection process of the ÖSYM and those without. Including populations from several universities would make the results more generalizable.

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APPENDICES

Appendix A

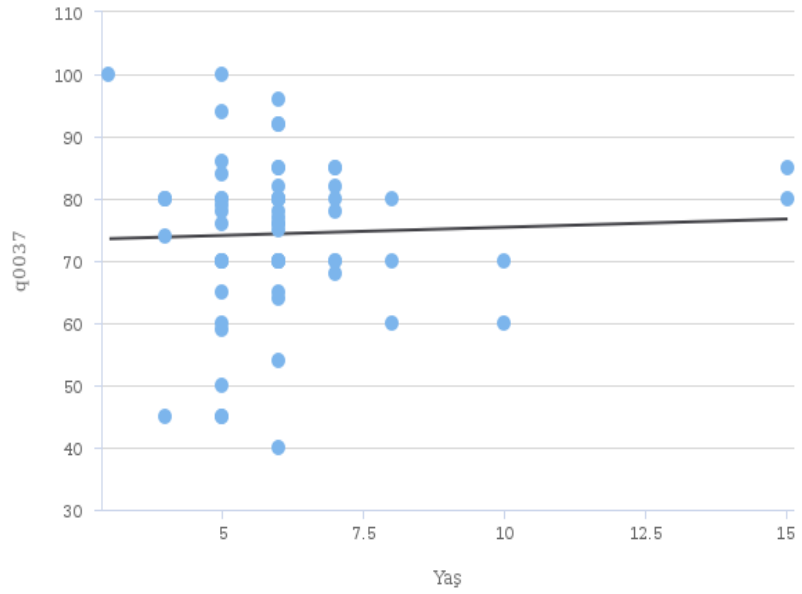
Correlation Between Age and Anatomy Scores.

X-axis is age and Y-axis is anatomy score

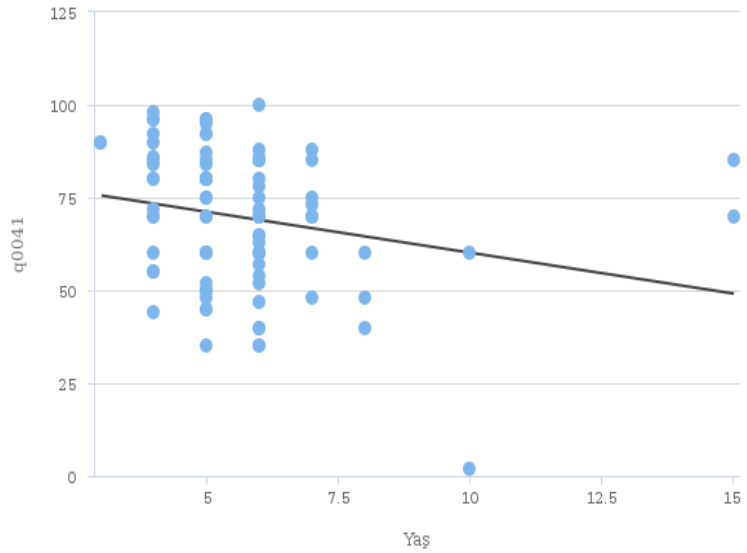
Note the following categorization for age:

1: 17	2: 18	3: 19	4: 20	5: 21
6: 22	7: 23	8: 24	9: 25	10: 26

Semester 4 - Year 2 Spring semester:



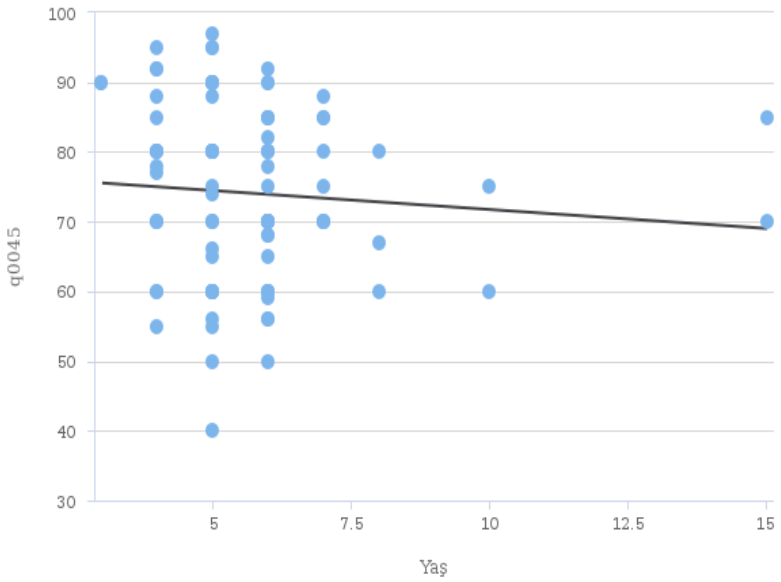
Semester 3 - Year 2 Autumn semester:



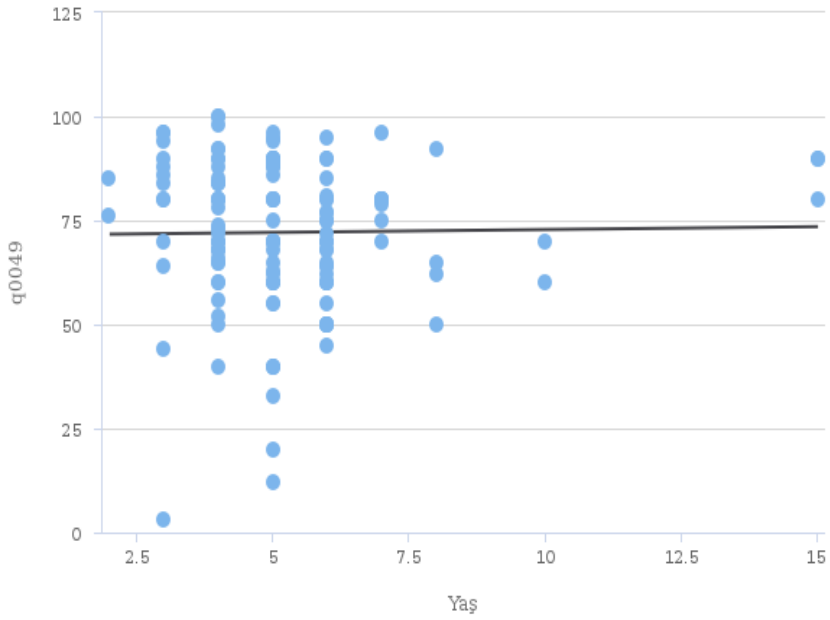
Appendix A – continued

Correlation Between Age and Anatomy Scores.

Semester 2 - Year 1 Spring semester:



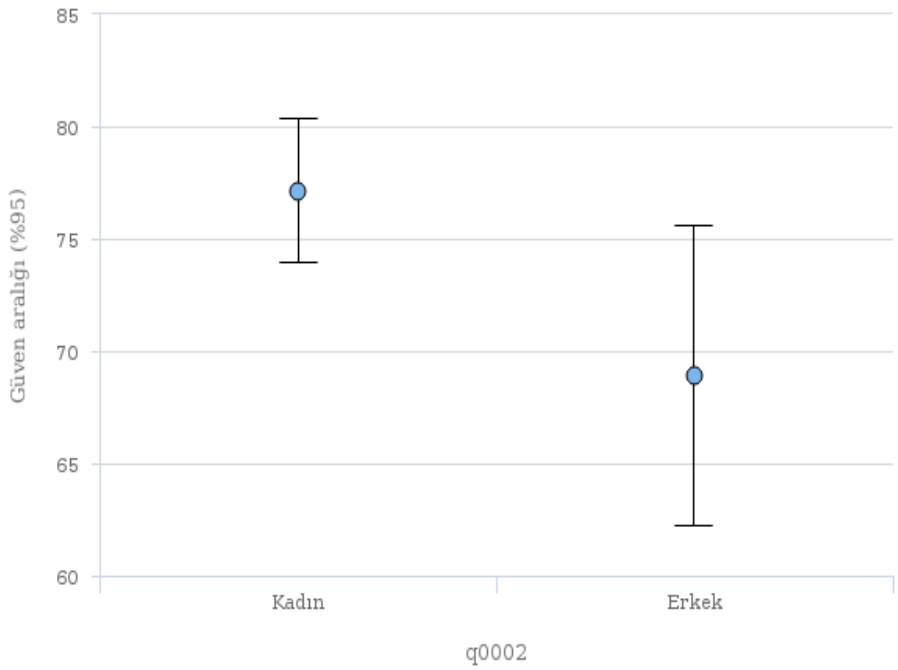
Semester 1- Year 1 Autumn semester:



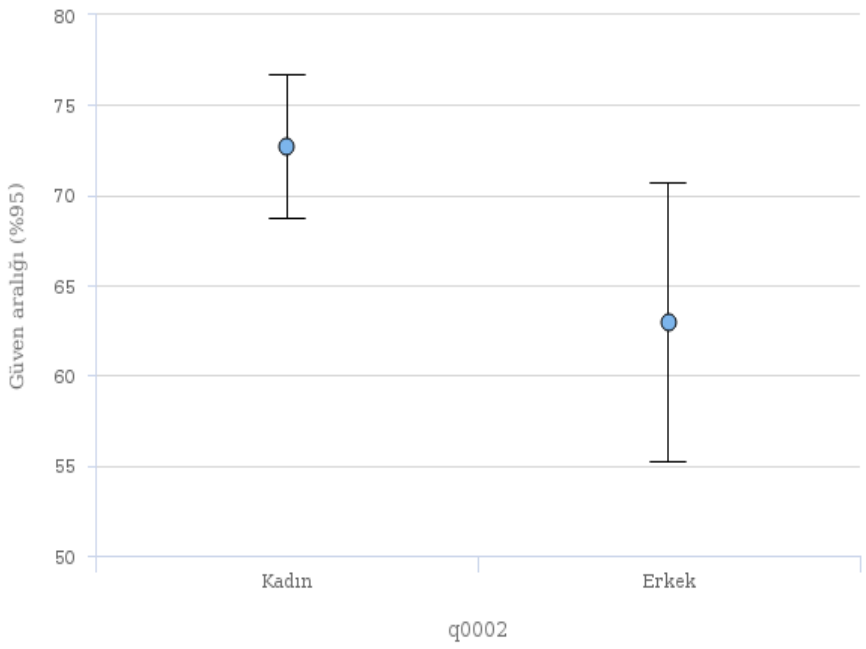
Appendix B

Anatomy Scores by Gender in Each Semester.

Semester 4 - Year 2 Spring semester:



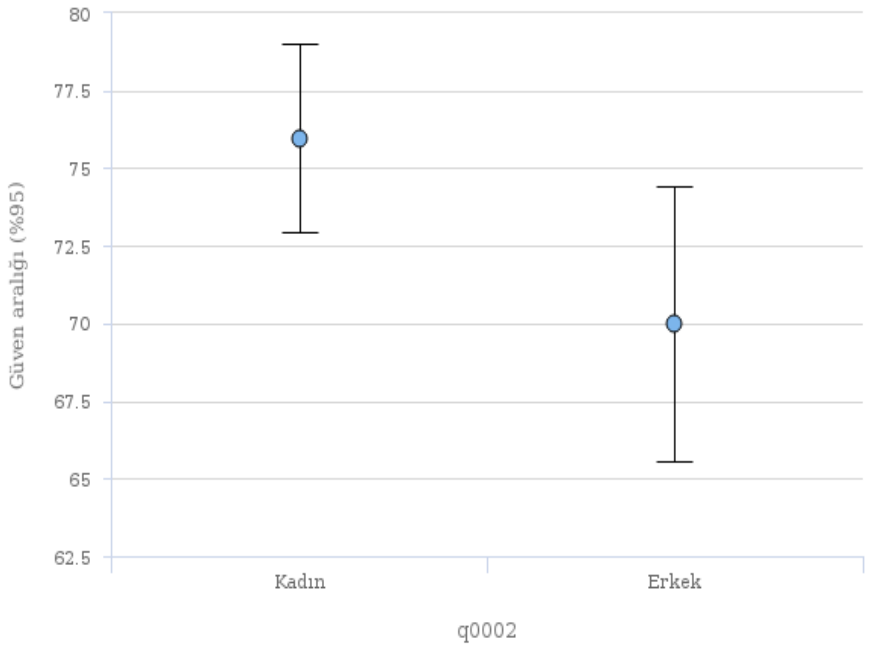
Semester 3 - Year 2 Autumn semester:



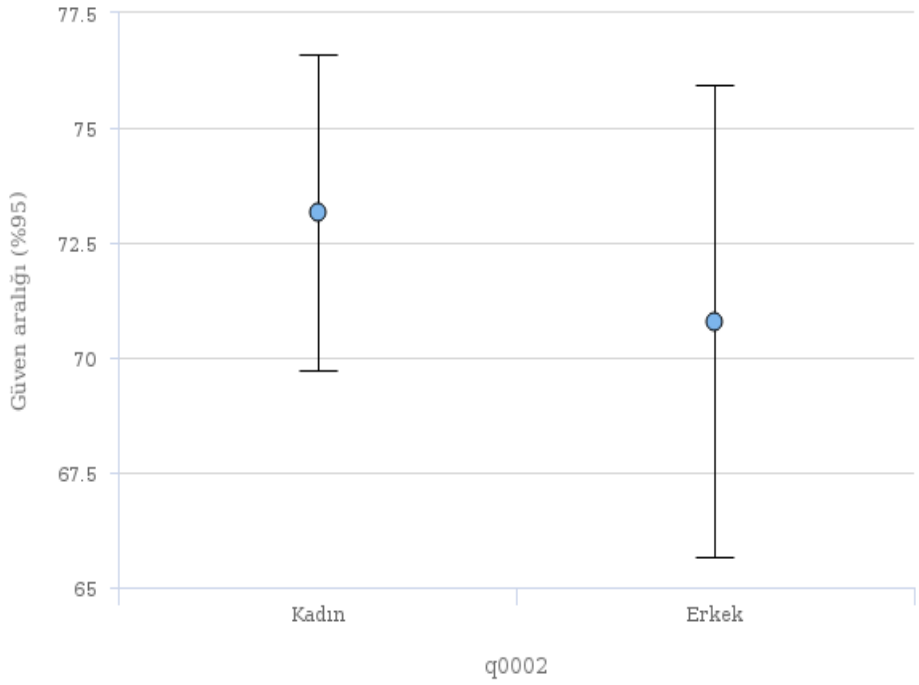
Appendix B – continued

Anatomy Scores by Gender in Each Semester.

Semester 2 - Year 1 Spring semester:



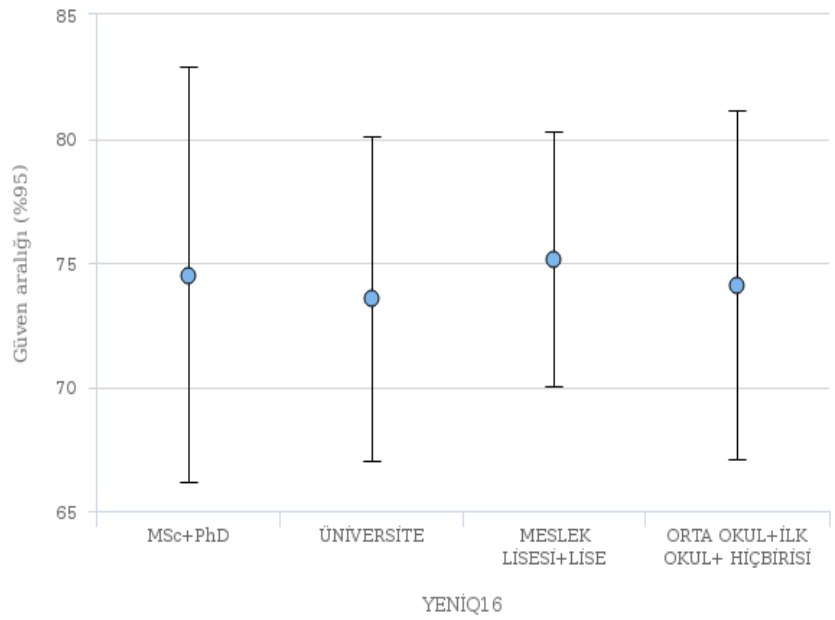
Semester 1 - Year 1 Autumn semester:



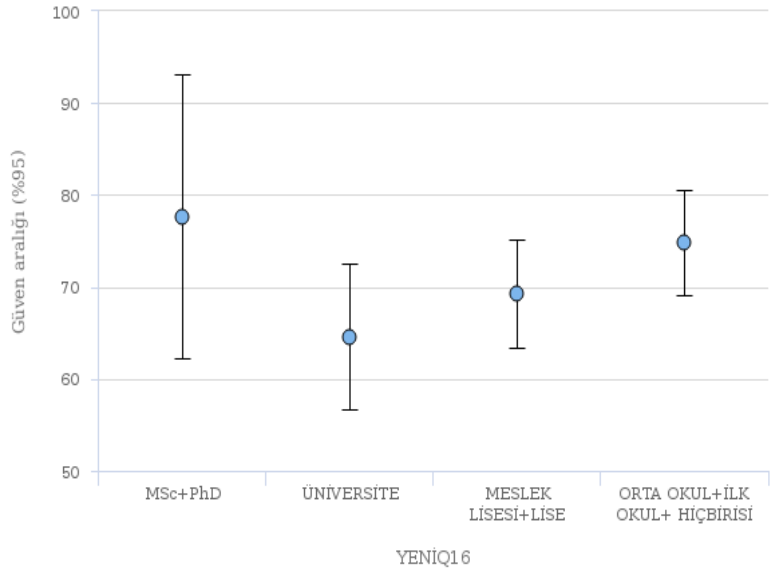
Appendix C

Mother's Education and Anatomy Scores

Semester 4:



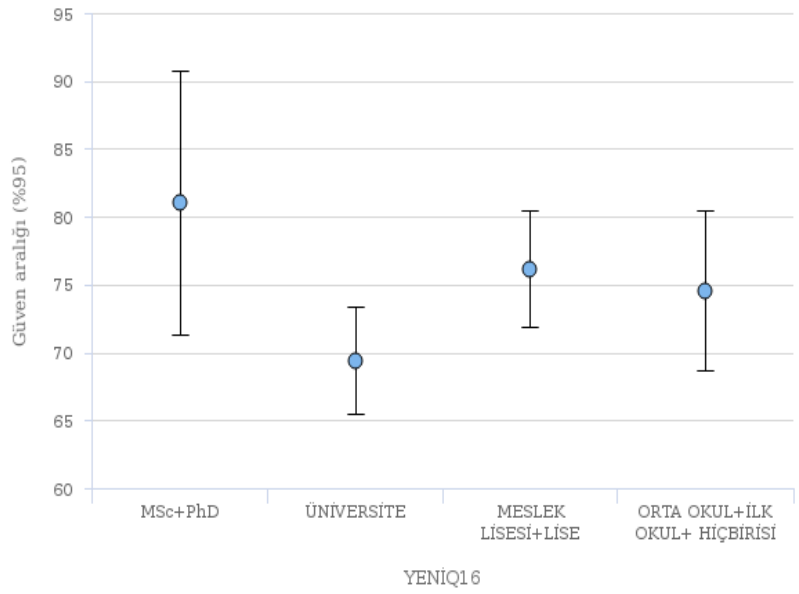
Semester 3



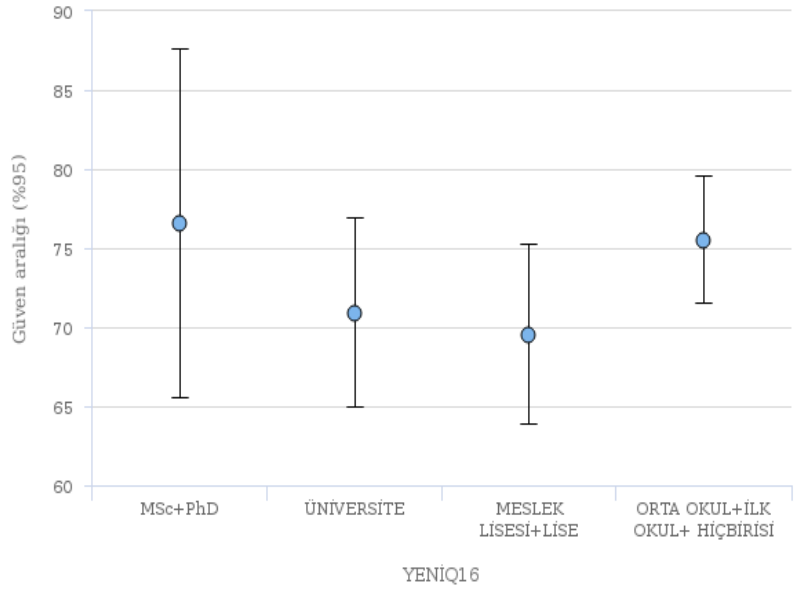
Appendix C – continued

Mother's Education and Anatomy Scores

Semester 2



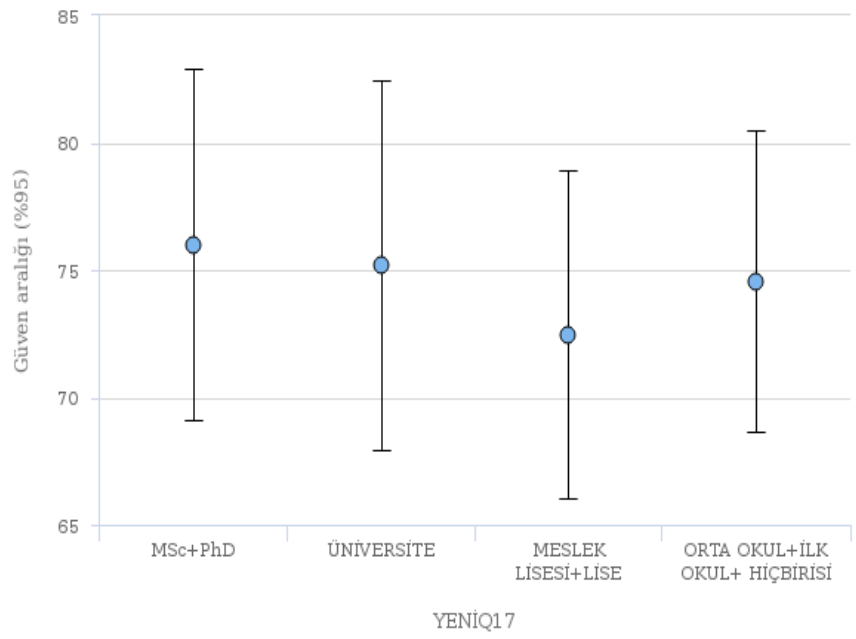
Semester 1



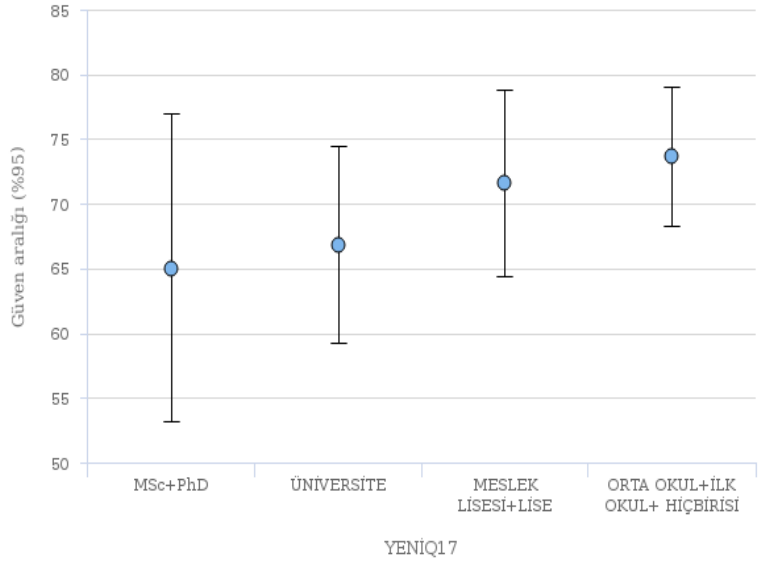
Appendix D

Father's Education and Anatomy Scores

Semester 4:



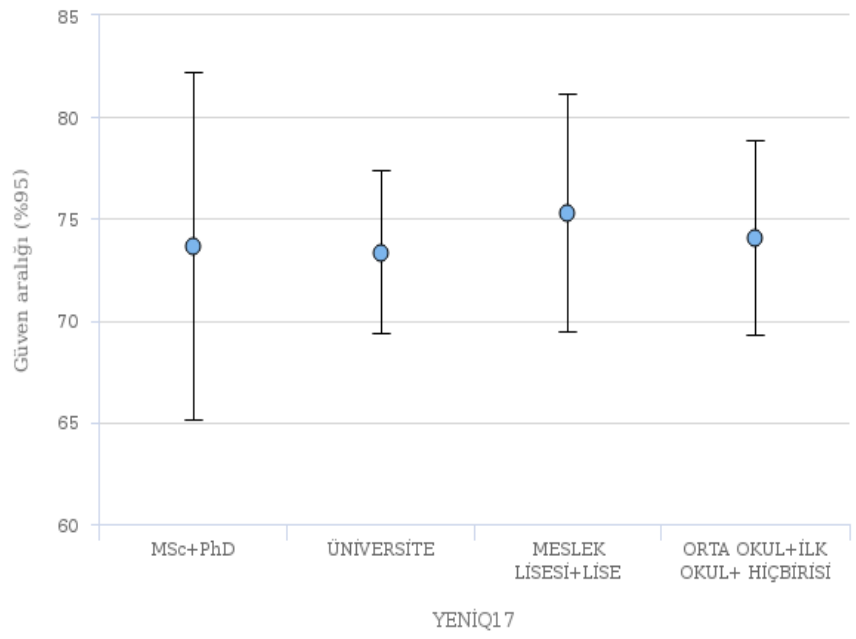
Semester 3



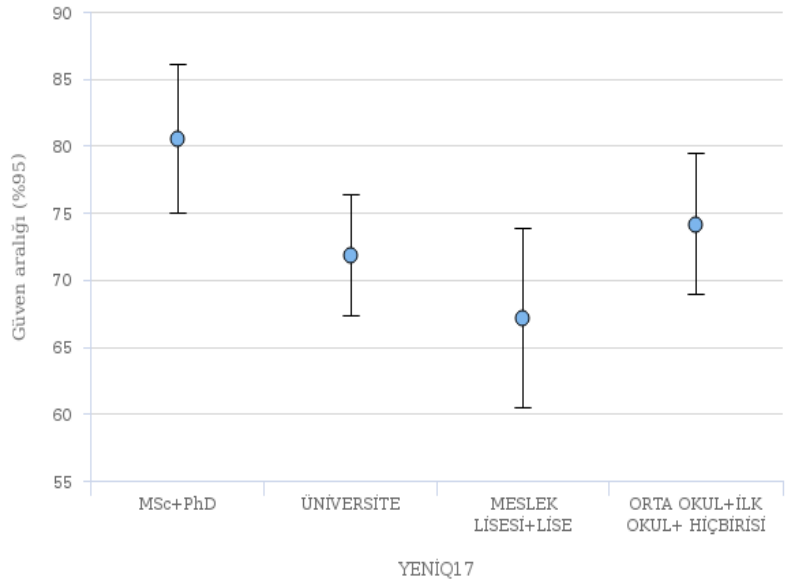
Appendix D - continued

Father's Education and Anatomy Scores

Semester 2:



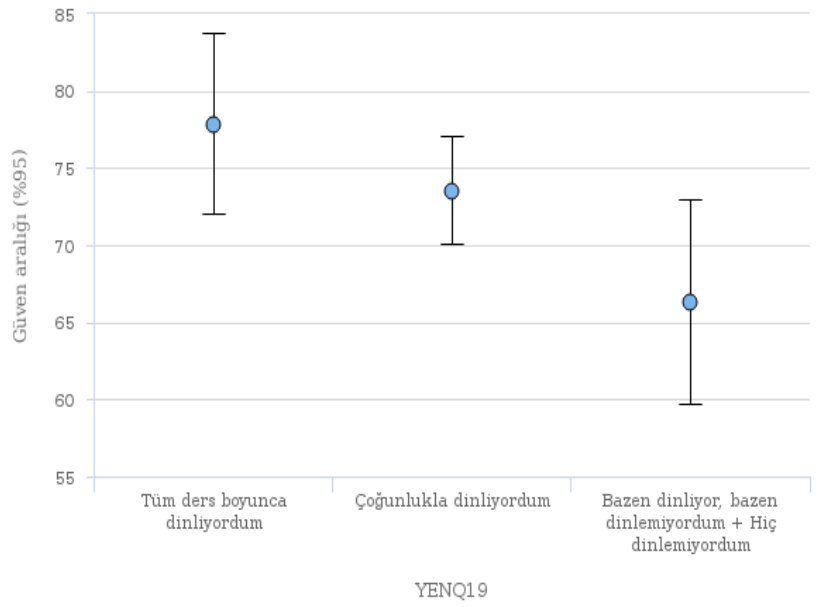
Semester 1



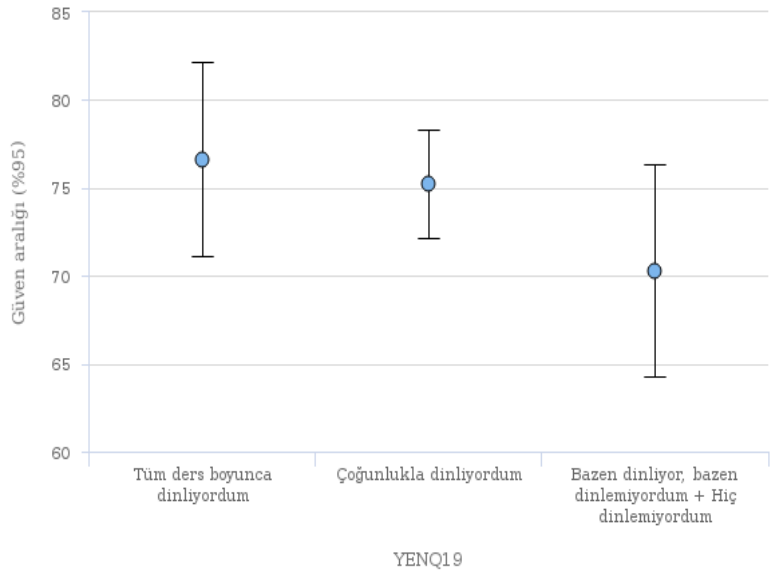
Appendix E

Listening to Anatomy Lectures and Anatomy Scores

Semester 1



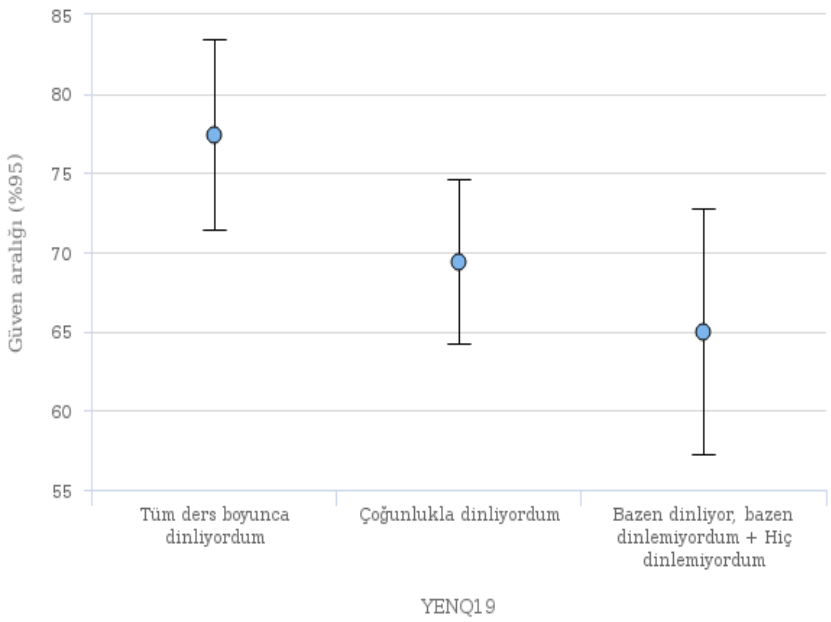
Semester 2



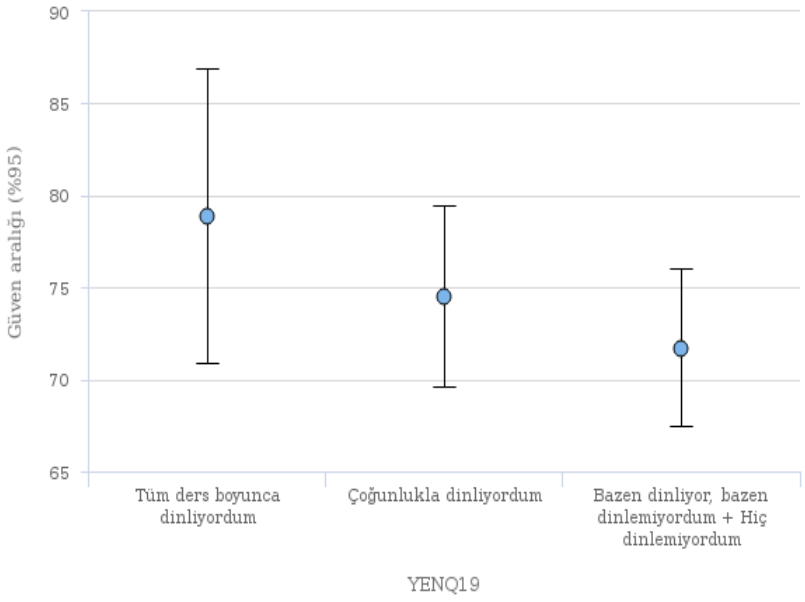
Appendix E - continued

Listening to Anatomy Lectures and Anatomy Scores

Semester 3



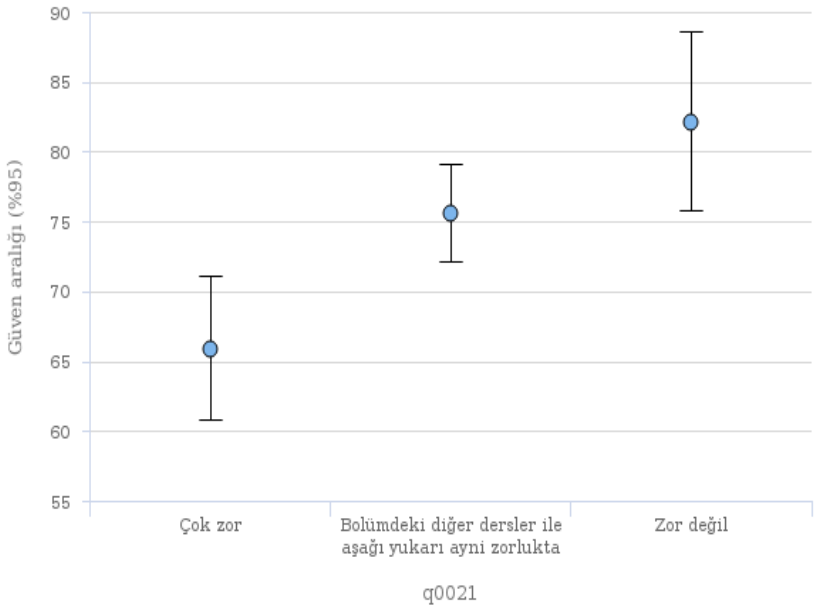
Semester 4



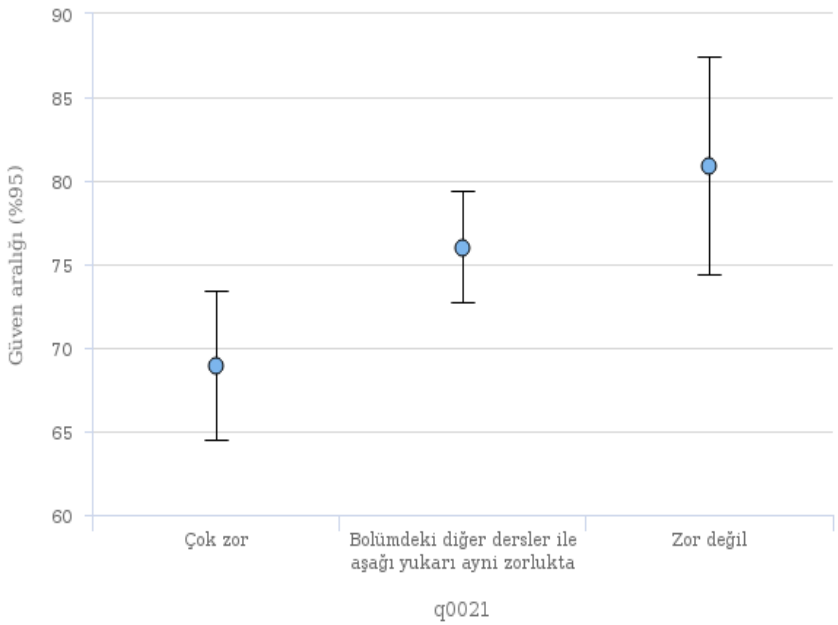
Appendix F

Anatomy Scores and Level of Difficulty Perception

Semester 1



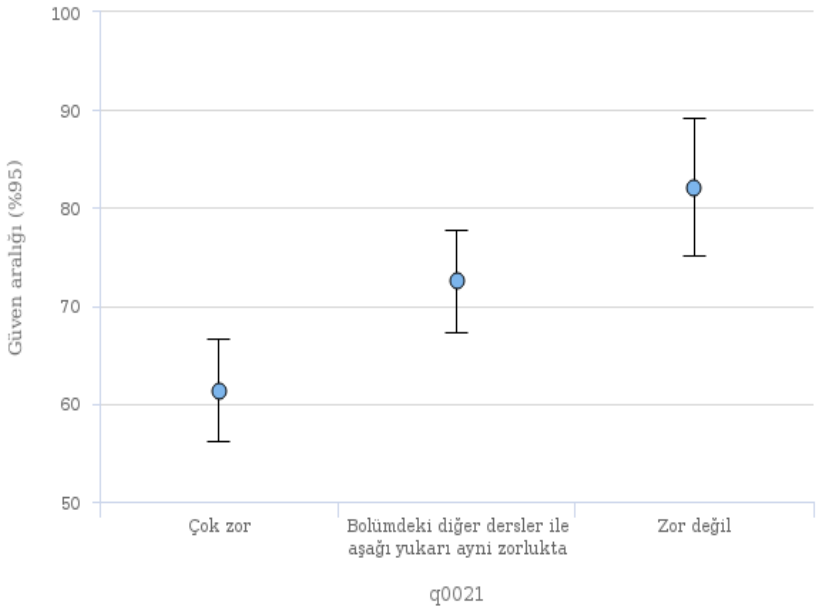
Semester 2



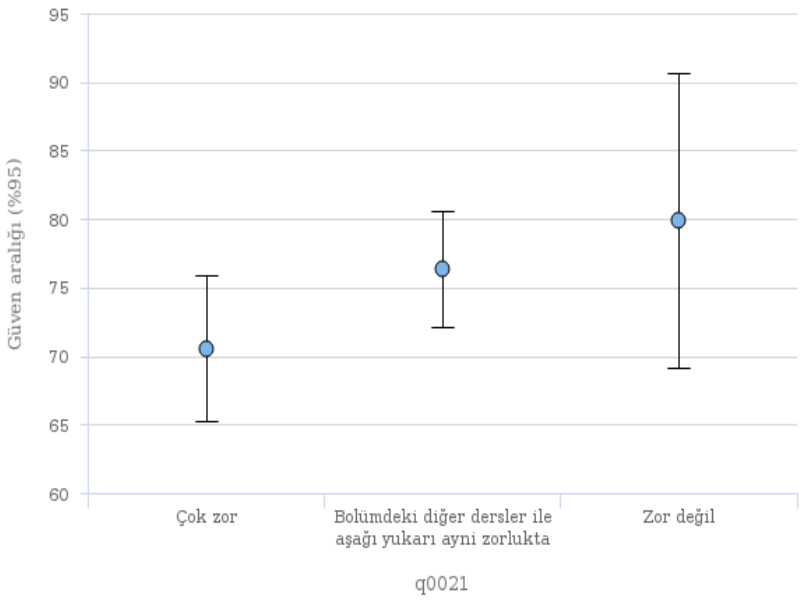
Appendix F - continued

Anatomy Scores and Level of Difficulty Perception

Semester 3



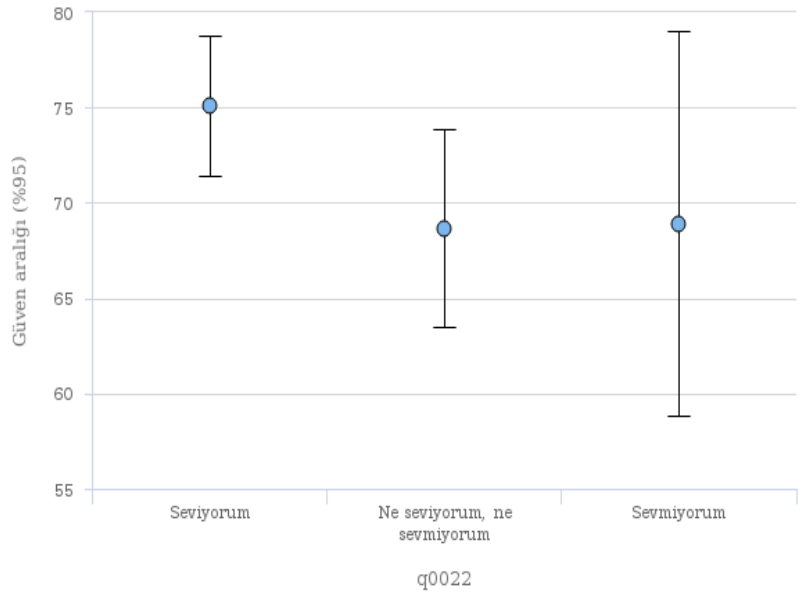
Semester 4



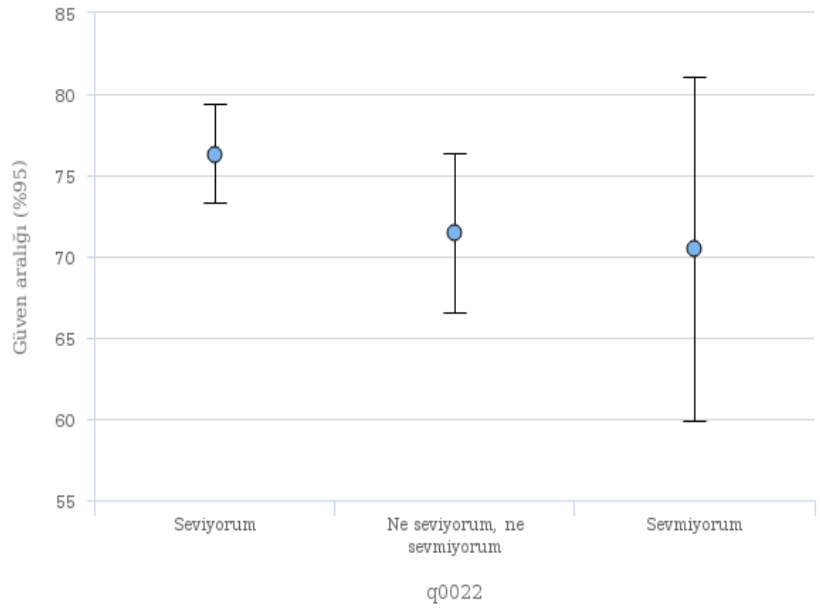
Appendix G

Like or Does not Like Anatomy and Anatomy Scores

Semester 1



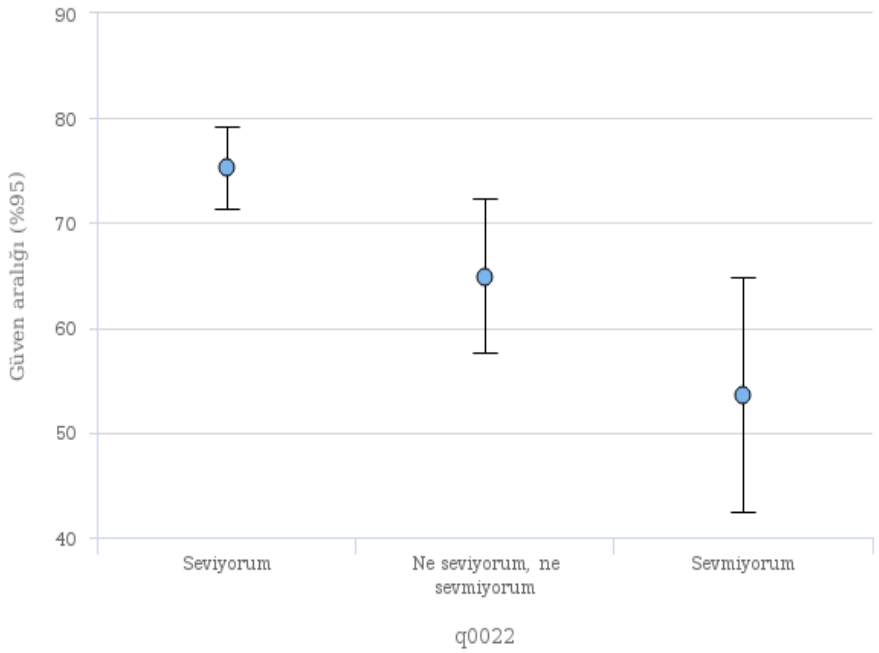
Semester 2



Appendix G - continued

Like or Does not Like Anatomy and Anatomy Scores

Semester 3



Semester 4