QATAR UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

FACTORS AFFECTING ACADEMIC DISCIPLINE SELECTION AND ACADEMIC

PERFORMANCE OF 12TH GRADE STUDENTS IN QATAR

BY

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ABSTRACT

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Title: Factors Affecting Academic Discipline Selection and Academic Performance of

12th Grade Students in Qatar

Supervisor of Project: Abdel-Salam, Gomaa, Abdel-Salam.

COVID-19 pandemic has led to the lockdown of major cities worldwide, which caused the early closure of schools and educational institutions in the towns affected. This pandemic had a negative impact on the performance of both art and science students. The data obtained from the ministry of education in Qatar. The data include grade 12 students' characteristics and scores in different subjects.

This study examines the factors that influence the selection of the academic major. It also predicts the factors impacting grade 12 students' performance in art and science courses. Results from 1,410 grade 12 students show that several factors such as gender, age group, nationality, GPA of art and science courses affect the selection of the academic major of grade 12 students. Moreover, the findings from this study revealed that in addition to the students' characteristics, the pandemic of Covid-19 had a negative effect on students' performance in both art and science courses.

DEDICATION

My project is dedicated to my family and my friends, especially my mother and my

husband. Without their support, I would not be able to finish my project.

ACKNOWLEDGMENTS

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CHAPTER 1: INTRODUCTION

The world has experienced one of the deadliest catastrophes in history, COVID-19, in the past year. It has led to the loss of human life and challenges the world's food systems, education, work, and public health. The social and economic disturbance caused by the epidemic has been devastating, exposing tens of millions to extreme poverty while approximately 690 million people are estimated to be undernourished (Who. int, 2020). Despite millions of businesses facing an existential risk and billions of the global workforce risk losing their livelihoods, impacts on the educational sector expose the future global operations to life-threatening risks. The education system prepares children for their future tasks, which, when disrupted or its quality lowered, could see failing healthcare systems, collapsing infrastructure and people sent to jail unlawfully. UNESCO indicates that more the 1.4 billion students have been affected throughout the global movement cessations and lockdowns, primarily in the second quarter of 2020 (Alfadala et al., 2021). While school closures eliminated the risk of learners contracting the coronavirus, their dream, health and safety was compromised. These factors reflect the impacts of the virus globally, where Qatar is not an exception. Children from different backgrounds, primarily in secondary schools, felt the impact of the virus which significantly affected their performance. It called for collaborative efforts to improvise a way to ensure learners continue with their education.

1.1. Pre and during impacts of Covid-19 on secondary school students

The Qatari government, on Monday, March 9, 2020, ordered the closure of all learning institutions, including primary and secondary schools. More than 90% of Qatar secondary schools were closed, affecting over 62,000 learners across Qatar (Chaabane et al., 2021). Secondary education is critical since it prepares learners for tertiary education, which is more practical. They learn different theoretical frameworks that

will be applied, which learning about their future careers in universities and colleges. However, due to the unprecedented outbreak of the pandemic, the learners had to remain at home for their safety. It seemed like the best precautionary measure but yielded impacts that risked the future of many Qatari secondary school learners. The pandemic had two major impacts on the learners, physical and emotional health and academic performance (Oecd.org, 2020). During the first months, it impacted all backgrounds despite their disparities since the future of the pandemic was unknown. Including the governments, schools, public health and parents were not prepared for a pandemic of COVID-19's magnitude (Sharma, 2021). It caught all stakeholders of the education sector by surprise, disrupting the education system. Therefore, children had to stay at home without any academic or physical activity, which affected their overall academic performance, psychological health, and physical health.

The secondary school system is designed to facilitate collaboration between teachers and students for the best academic outcome. Despite those students can learn on their own, they need the assistance of teachers to understand new concepts. COVID-19 left secondary school learners without assistance from their teachers, which is core to their academic performance. The Qatar Foundation reported that learners' academic performance is likely to decrease after COVID-19 (Nuaimi et al., 2021). Educational agencies feared that children would lose academic focus the more they stay without learning. They will develop an interest in other activities such as social media, which will take up most of their time. Although the pandemic and lockdowns present an opportunity for children to function independently in terms of learning, there were many barriers to quality education. Learners with disparities are more likely to get distracted by the situation at their homes. Disabled children such as the visually impaired did not have the infrastructure they needed to learn efficiently, lowering the

quality of education. The effects of the pandemic affected even children from financially able families because the home environment is not conducive to education (Sparks,2020). These factors led to an overall drop in the academic performance of secondary school learners.

Schools present learners with an environment where they can engage academically, psychologically and physically. Children acquire education in schools and help them lead healthy physically, emotionally, and mentally. Secondary schools in Qatar have infrastructure that helps children discover their talents and develop them, contributing to their academic performance. Every day, children have to engage in physical activities that help them maintain their physical fitness. According to the Qatar Foundation (2020), sporting activities such as football, table tennis and quizzes should be core to secondary school education. Each learner should participate in the sport that interests them to challenge themselves constantly. Through physical activities and socializing with cohorts, the learners are less likely to develop psychological problems. Also, the teachers can identify when a learner has a psychological problem and help them or recommend specialized care. COVID-19 placed the children at home with fewer physical activities and no socialization. Therefore, secondary learners risk becoming overweight or developing mental conditions (Sharma, 2021). Dreams and future prospects start to build during secondary school. Students are likely to develop depression and get frustrated by the pandemic since their dreams have been halted.

1.2. Qatar education system actions

Secondary school students were losing academically as the pandemic continued to spread. There was an increasing need to improvise ways to ensure students continue with their academic activities since the pandemic did not show signs of ending. Qatar education systems developed several methods to deliver education and guidance to all

children, including secondary school learners. The methods considered all learners despite their disparities. Online learning was the most adaptable and efficient for most learners, ensuring that their health was not compromised. The government activation of the Microsoft Teams platform for all learners in Qatar (UNESCO). However, the education system needed methods to ensure every learner access online learning and a smooth transition from classroom to online learning (Naji et al., 2020). According to Nuaimi et al. (2021), the Qatar education system delivered education by developing and deploying online resources, professional development, and online teaching and learning and research. Each factor played a crucial role in ensuring the students access quality education. The system first ensured that students had the resources they needed for education were available for each student across Qatar (Al-Jaber et al., 2020). These resources included the internet, electronic gadgets and electricity. It was made possible by collaborations between the parents, government and secondary schools.

Professional development ensures that all teachers are well equipped to use online resources to deliver quality education. Most teachers are not familiar with some technologies, which developed the need for coaching to ascertain the quality of education does not reduce (El-Masri, 2020). Online teaching and learning were delivered in multiple ways. One of the most effective platforms is Microsoft Teams which was successfully used by many institutions and was efficient for many learners given that it was free (Al-Jaber et al., 2020). Also, some schools used their online school portals for video learning, but it was primarily used for exams and assessments. Microsoft Teams and online learning portals ensured that education in secondary school continued despite the severity of COVID-19. Also, other online platforms were used, such as television-based, radio-based and online platforms such as YouTube learning (UNESCO). The platform used depended on the course. Also, online platforms enable

the students to learn about various indoor activities that help them keep fit and remain stable mentally and emotionally. Also, they could socialize with their peers and teachers after lessons. Collaborative efforts ensured that secondary school students continued to pursue their dreams by ensuring their academic activities did not stall. Also, the students learned through research on different assignments.

1.3. Post-Covid impacts

COVID-19 outbreak forced homeschooling for most secondary school students in Qatar. Educational institutions adopted a virtual delivery of education which helped reduce school expenditures (Sharma, 2021). Most educational and physical activities were conducted at home throughout the Covid period. The students and teachers adapted to unction within homes, significantly impacting education systems and institutions. Fewer learners are willing to resume face-to-face education. They prefer homeschooling which has significantly reduced the number of students attending school. It has cost the jobs of many teachers and the financial stability of some educational institutions. However, COVID-19 has triggered innovation in the education sector in Qatar (QCDC.org.qa, 2021). Secondary school students have access to vast online academic resources. They have developed self-dependence in academics which improves their academic performance. Education institutions can now deliver quality education to students at home and schools.

1.4. Objective

The study's primary objective is to identify the factors affecting the academic discipline selection and the performance of Qatar secondary school students. These factors include the student's gender, nationality, age group, academic major, the academic year (before and during Covid-19), and students GPA in art and science courses. It investigates how each factor affects students' academic performance and selection of academic discipline.

1.5. Motivation

COVID-19 outbreak has impacted the education sector significantly. By March 2020, approximately 165 countries had shut down their educational institutions affecting more than 1.5 billion learners globally (Azevedo et al., 2021). It amounts to 87% of the global student population (UNESCO). Qatar is among the regions significantly impacted by the pandemic. It affected the performance of secondary school students academically and health-wise. Despite that education systems were positively impacted during the post-COVID, it put the future of secondary school learners at scrutiny upon its outbreak. Many factors have affected secondary school students, including the environment and accessibility and availability of educational resources. Education forms a foundation where children pursue their dreams and become productive members of society. Most students choose their career paths when they are in secondary school. Therefore, disruptions can kill dreams for some students, which will affect the overall output of future generations. Qatar's secondary school education is crucial since it introduces theoretical concepts that prepare learners for their future career paths. Also, the pandemic outbreak has shown the ability of the Qatar education system, which incorporates the government, parents, educational institutions and the students, to adapt to sudden changes (Brewer et al., 2017). The efforts witnessed in Qatar can be applied in other countries or used to prepare for future catastrophes that might halt secondary school education.

CHAPTER 2: LITERATURE REVIEW

The outbreak of the Covid-19 pandemic in 2020 forced governments across the world to impose movement restrictions to curb the spread of the virus. Countrywide shutdowns were implemented, which led to the closure of educational institutions including suspension of in-person learning. School closures affected billions of students worldwide. As governments examined ways of ensuring continued learning, a majority implemented distance-learning models. Owing to the aforementioned measures, the topic of the impact of Covid-19 on school performance has now emerged. Currently, there are considerable conversations globally regarding Covid-19 causing school closures and its effect on academic performance among students. The current literature review examines the scientific literature related to the effect of Covid-19 on academic performance on secondary school students. The objective is to synthesize relevant evidence regarding the topic from diverse studies to understand how interruptions to school services due to Covid-19 affected educational outcomes and academic achievement among students.

2.1. Existing literatures

Schramm et al. (2021) investigated the relationship between Covid-19 and student grades at a high school in California. Specifically, the researchers considered the Covid-19 disruption and the emergence of distance learning models to understand the way the new models affected student grades. Consequently, the researchers used a case study methodology to explore the issue in which they selected one secondary school, the Pacific Grove High School in California, as the case for the study. The school shifted all its learning activities online in March 2020 and had about 600 students aged 14-18 and in grades 9-12. They examined 40,000 records comprising of grades of the students per course during the studied semester and focused on the period 2016 to 2021. The

data was also coded to avoid identifying individual students. The researchers used the R statistical programming language to analyze the data. The findings show a slight improvement in grades during the online learning period in core courses. The researchers also found that online learning influenced the gender differences in grades D and F through stabilizing the grades besides resulting in high grades among female students on average compared to male students. Other observed effects include alleviation of test anxiety, helping students feel confident in their abilities, and pressure to perform from students, peers, or parents. Overall, the researchers concluded that online learning due to Covid-19 had a net positive effect on the case study school. Similarly, Engzell et al. (2021) evaluated the way school closures due to Covid-19 affected the performance of the primary school in the Netherlands. Considering that, national examinations in the country occurred before and after Covid-19 based movement restrictions, the researchers compared performance during the lockdowns with the same period in the previous three years. They sampled 15% of primary schools in the period 2017-2020 involving students aged 8-11 years in grades 4-7. They also analyzed 350,000 data sets comprising of biannual scores in core subjects besides considering other factors such as school features and demographics. The researchers investigated the effect of Covid-19 lockdowns on learning and students from less-educated families. They also examined differences in effects based on prior performance, subject, school grade, and sex.

The data analysis procedure entailed an assessment of standardized tests in reading, spelling, and math besides an evaluation of the composite score of the three subjects. They changed the results into percentiles using different uniform distributions based on individual subjects, grades, and testing occasions. They also compared the baseline year of 2020 to the previous three years based on composite scores of student

performance in the three subjects. Additionally, the researchers conducted a placebo analysis to confirm the reliability of their baseline specification, inspected performance on generic tests of learning readiness to identify what affected performance, and adjusted for loss to follow-up. The adjustment entailed discarding students who did not take tests, balancing control and treatment groups, and restricting the analysis to schools in which two-thirds of the students took tests after lockdown. They also used fixed-effect models to adjust the analysis to time-invariant confounding at the family and school levels. The researchers found that students engaged in less learning across all subjects and ages during lockdowns compared to typical study periods. Specifically, quantified performance losses reached three percentile points in which students from disadvantaged homes were affected disproportionately. Besides, for the less educated families, the performance losses were 60% higher than in the general population. The researchers concluded that the performance losses accounted for a fifth of the entire school year.

Another study by Sintema (2020) investigated the potential effect of Covid-19 on student performance with a focus on grade 12 students. The researcher hypothesized that in 2020, Covid-19 would affect grade 12 students negatively concerning national examinations in three subjects including design and technology, science, and mathematics. The study was conducted in Zambia, a country that had just implemented a nationwide STEM education and with limited technological resources. STEM education means that is seeking to appoint a Teaching and Learning Coordinator for these subjects (Science, Technology, Engineering, and Mathematics)

The researchers used a qualitative design with a focus on a case study strategy in which three cases were included. A single public school was selected from Chipata district in which data collection entailed interviewing three teachers at the school who were selected using purposive sampling. The interview protocol included seven semi-structured questions. The researcher conducted telephone interviews with three science and mathematics teachers owing to movement restrictions imposed due to Covid-19. Each interview lasted for 20 minutes on average. An Android application was used to record the phone conversations before the researcher transcribed and analyzed the data using the constant appropriate qualitative data analysis procedures. The researcher found the potential adverse effects of Covid-19 on the education sector in Zambia due to the loss of contact hours for students in secondary schools and inadequate e-learning resources. Besides, the pandemic had potential negative effects on STEM subjects due to the expected reduced performance in national examinations. The researchers suggested that future studies could use both qualitative and quantitative techniques to examine the effects of the pandemic on educational planning nationally.

Aji (2021) also investigated the effects of Covid-19 on the academic performance of senior secondary school chemistry students in Nigeria following the lockdown imposed in March 2020 to contain the pandemic. The main objectives of the researcher included investigating whether Covid-19 affects the academic performance of senior secondary school chemistry students and investigating whether Covid-19 affects the academic achievement of senior secondary school chemistry students. The researcher hypothesized that the mean scores of students in senior secondary school chemistry would not differ significantly before and during Covid-19 and the mean scores of the students would differ significantly before and during the pandemic. The researcher used a quantitative methodology in which a descriptive cross-sectional

survey study design was used. The research occurred in Yobe State in which two senior secondary, including one public and one private, schools from the Bade local government, Gashua town were selected. The schools had 289 students but the researcher included a sample of 20 students for the study comprising of female and male students with diverse religious beliefs ad backgrounds. Data collection occurred before Covid-19 and during the pandemic period and entailed survey questions regarding student scores. T-test was used for analyzing data in which the researcher analyzed the data at a 5% significance level. The study findings demonstrate that all the formulated hypotheses were rejected in the studied schools.

Other researchers examine the effect of Covid-19 on higher education institutions. For example, Gonzalez et al. (2020) investigated the effect of Covid-19 confinement on the performance of higher education students. Specifically, the study involved students from Universidad Autonoma de Madrid in Spain. The study intended to decrease uncertainties regarding the assessment process in higher education institutions during the pandemic to identify the effect of Covid-19 on the performance of students. Thus, the researcher sought to examine the learning strategies of students before and after Covid-19 confinements. The researcher hypothesized that Covid-19 confinement affected the performance of students significantly and Covid-19 affected the assessment process significantly. Two online platforms, including the e-valUAM and the Moodle platforms, were used for tests. The researchers also used different measurement instruments including the CAT theoretical model, multiple answer test, open answer test, and traditional tests to assess student performance in various subjects. The study population included 458 students and 3 different subjects including metabolism, design of water treatment facilities, and applied computing. The researchers divided the students into two groups, the control and experimental groups,

to examine differences in assessments.

The control groups comprised of students dealing with the metabolism and applied computing subjects during the 2017/2018 and 2018/2019 academic years in addition to the students dealing with the design of water treatment facilities subject during the 2017/2018 academic year. For the last group, the researchers conducted a longitudinal study in the 2017/2018 academic year to examine the way rewards affected the learning strategies of students. The experimental group comprised of students dealing with metabolism and applied computing subjects during the 2019/2020 academic year. The experimental group corresponded to the third stage of the longitudinal study conducted with the students dealing with the design of water treatment facilities. The researchers studied the autonomous learning approaches in both groups based on the aforementioned measurement instruments. Once the researchers obtained correct autonomous learning measures, they developed an experiment to investigate the effects of the pandemic on the performance of students by comparing the results of the experimental and control groups in the entire assessment process. The experiments were conducted during the mentioned academic years for each subject and with 458 students. The researchers conducted statistical analysis on the results obtained from the different measurement instruments and using GraphPad Prism 6.

The researchers found that Covid-19 confinement had a significant positive effect on the performance of students since students attained better scores in the different tests after the confinement. There were also significant differences between performance before confinement and performance after confinement. The positive effect of Covid-19 was significant in activities that did not change in format after confinement. Confinement also changed the learning strategies of students as students

adopted a continuous learning habit, which enhanced efficiency. Thus, the researchers concluded that Covid-19 improved student performance by improving their learning performance.

Maldonado and De Witte (2021) also highlight the effect of the Covid-19 crisis in the provision of education and the limited nature of studies about Covid-19 consequences. In a discussion paper examining the Covid-19 effect, the researchers assessed the effects of Covid-19 imposed school closures on standardized tests in Belgian Flemish schools during the final years of primary school. The study was conducted in the period 2015-2020 with different schools and across various subjects. The study was conducted in Flanders involving a network of catholic schools and students in the sixth grade. The researchers evaluated standardized tests that are administered at the end of the year in which they collected individual data about tests and combined the data of different subjects for a single student by identifying students with numbers to ensure anonymity. They also aggregated the data at the school level to compare different cohorts. The analysis was conducted at the school level. The researchers divided their sample into three periods during the analysis including a comparison of the 2019-2020 period, 2017-2020, and 2015-2020 while controlling for the test version. The analysis also entailed administrative data covering general school features including student numbers and gender distribution per school, number of teachers by age group, special needs schools, and the share of students with special needs, socio-economic background of students, and the immigration background of students.

The researchers first conducted telephone surveys with school management to evaluate the Covid-19 situation during closures before sampling 1018, 1034, 1062, 1152, 1164, and 402 schools in 2015, 2016, 2017, 2018, 2019 and 2020 respectively.

T-tests were conducted on the data before combining the various data sets from different schools into a panel of data set in which the data was structured to compare schools over different periods based on difference-in-difference estimation. The findings show that students from the 2020 cohort lost significantly concerning learning in all evaluated subjects. Besides, there was a notable increase in inequality across and within schools in 2020 while students with a low socioeconomic status lost more than did other students.

A study by Lewis and Kuhfeld (2021) also demonstrates the way Covid-19 disrupted student academic performance by affecting disadvantaged students disproportionately. The study focused on investigating the effect of Covid-19 on mathematics and reading outcomes among students in the United States. The investigations illustrate that students performed poorly at the start of the school year following the pandemic compared to pre-Covid-19 years with low performances in reading and mathematics that experienced 3-7 and 9-11 percentile point reduction respectively. Even though all students had low achievements, disadvantaged students including those from marginalized and those with low socioeconomic status experienced disproportionate effects, especially those in grades 3-6.

In the study, the researchers compared MAP Growth scores from fall 2021 of 6 million students in public schools in the United States in grades 3-8 with scores of students at the same level in fall 2019. Specifically, the researchers employed cross-sectional analyses to gain insights into student achievements during and before the Covid-19 crisis by calculating median percentile ranks of students during the aforementioned periods and the difference in the percentiles between the two periods. The researchers found that student performance in math and reading lag historical averages and low performing students before the pandemic gained less compared to

high performing students. The researchers suggested that Covid-19 disruptions in schools affected the acquisition of math skills compared to reading skills significantly. The findings also highlight the inequalities regarding unfinished learning during the pandemic owing to its disproportionate effect on disadvantaged students. The researchers also noted that even though there is a return to in-person education, the Covid-19 effect in education is ongoing and disruptions to learning, particularly to vulnerable students continues.

Breaux et al. (2021) who investigated learning experiences during the 2020/2021 school years and the effect of Covid-19 on high school students GPA found similar findings. In the study, a sample of 238 high school students comprising 55.5% male and 49.6 with ADHD from the U.S were recruited. Online surveys were conducted in which students reported their GPAs. The study found a significant reduction in GPA from the 2019/2020 to 2020/2021 school years. Besides, biological sex and ADHD status moderated the effect in which male students and those with ADHD received significantly lower GPAs compared to female students and those without ADHD. Disadvantaged students such as those with low socioeconomic backgrounds and the marginalized were affected disproportionately.

Owing to the different effects of Covid-19 on the academic performance of students, Chen et al. (2021) note the various responses of schools to the pandemic and highlights the effect of the pandemic on student performance, particularly among disadvantaged students. According to the authors, the Covid-19 pandemic forced teachers to adopt e-teaching models to ensure safety. Nevertheless, online teaching does not offer similar benefits that in-person teaching does. Thus, the researchers conducted a teacher survey across the world to understand the effectiveness of e-learning during the Covid-19 crisis. Specifically, the researcher investigated the effect of e-learning on

student learning based on the views of teachers owing to the knowledge of teachers about student performance. Teachers from the United States, the United Kingdom, Japan, Germany, France, China, Canada, and Australia were surveyed in the October-November 2020 period. The researchers asked teachers to reflect on their experiences during the pandemic when schools adopted remote learning models. Teachers were required to rank the effectiveness of e-learning on a scale of 1-10 in which one demonstrated the least effect on academic performance while ten indicated comparable academic performance to normal in-person education.

The findings show that e-learning led to better academic performance in Germany, Canada, and Australia with scores above five compared to other countries that had scores below 5. In contrast, for Japanese teachers e-learning led to poor results concerning academic achievement. On average, public school teachers gave scores of 4.8 compared to scores of 6.2 for private schools. Socio-economic status influenced the scores in which teachers from disadvantaged locations rated the effectiveness of remote learning with scores of 3.5 in which they argued that the pandemic worsened education inequalities. Nevertheless, teachers from private and wealthy schools reported better academic performance due to the availability of the required resources such as the internet and the necessary devices. The researchers concluded that the pandemic had disproportionate effects on disadvantaged students than on well-off students. Overall, the pandemic resulted in a learning loss of about 2 months for high schools even though disadvantaged students lost about 3 months of school time.

Tomasik et al. (2020) analyzed data to investigate the effect of remote learning due to Covid-19 restrictions on schools. The authors note the absence of empirical evidence regarding the impact of Covid-19 based school closures in actual size and direction. They conduct their study in Switzerland following the halting of educational

activities in March 2020 and their reopening eight weeks later. The closure resulted in the adoption of distance learning models. Thus, the objective of the researchers was to compare distance learning and in-person learning to identify the potential effect of the pandemic on learning progress. They formulated three hypotheses. In the first hypothesis, they stated that the absence of institutional schooling leads to slow progress or decreased competence, particularly for vulnerable students. For the second hypothesis, they stated that the institutional effect did not diminish completely since learning occurred in another way. They also hypothesized that the effect of school closures would be significant for young students compared to older students due to factors such as self-regulation abilities, cognitive scaffolding, and socioemotional strains of the pandemic.

The researchers achieved their objective by recruiting the active users of the MINDSTEP system who completed at least a single teacher based evaluation in the period January 19, 2020-May 11, 2020. Students from grades 3-9 use the MINDSET system in Switzerland for French, English, German, and mathematics subjects. The researchers obtained data on German and mathematics assessments only. The study sample included 28, 685 students of which 13,134 students were from primary school while 15,551 were from secondary school. The age of students ranged from 9 years to 15 years in grades 3-9 respectively. Boys accounted for 50.3% while non-native speakers accounted for 30.8% in the primary school sample. For the secondary school sample, boys and non-native speakers accounted for 49.1% and 32.7% respectively. The researchers modelled the students in a second-order piecewise latent growth model based on strict invariance measurement for the study period. Specifically, they used the lavaan package of R to conduct all computations and addressed missing data with the full information maximum likelihood (FIML) technique. The findings demonstrate

that school closures did not affect secondary students significantly concerning learning gains. Nevertheless, the closures slowed learning among primary school students. While distance learning was effective as an emergency measure, it does not benefit all students equally.

Hammerstein et al. (2021) also consider the emerging evidence about the effect of Covid-19 on academic performance. The researcher conducted a systematic review regarding the differential and general effects of the pandemic on achievement in primary and secondary schools. The researchers searched for relevant studies dealing with the effect of Covid-19 on student achievement using the Web of Science database. Only articles published in the 1 March 2020-30 April 2021 period were selected. They searched the CCR-EXPANDED, ESCI, BKCI-SSH, BKCI-S, CPCI-SSH, CPCI-S, A&HCI, SSCI, and SCI-EXPANDED indexes. They also searched articles from pre-print servers including SocArXiv, EdArXiv, and PsyArXiv. The Risk of Bias in Non-Randomized Studies of Interventions technique was used to conduct the Cochrane Risk Assessment. The researchers selected eleven studies for the final analysis in which they obtained data about the differential and general effects of Covid-19, converted the general effects in various metrics to changes using SD, and computed the media of the effects.

The study found that Covid-18 affect student achievement adversely, particularly among young students and disadvantaged students. Specifically, remote learning did not offer beneficial effects and their effects did not differ with the complete absence of teaching. Nevertheless, increased use of software for studying subjects and familiarity of students with remote learning enhanced student achievement in online programs. Systematic online materials also benefited low achieving students more than

they did high achieving students.

Researchers have also conducted studies in the Middle East concerning the effect of Covid-19 on educational achievement. For example, Khlaif et al. (2021) conducted a study to examine the challenges related to remote teaching in Afghanistan, Libya, and Palestine in middle school settings. Owing to the role of digital inequity and digital privacy in remote learning, the researchers adopted a qualitative methodology in which they obtained data using observations and semi-structured interviews. The researchers also recruited teachers, students, and parents using purposive sampling from the three countries and sampled 20 participants from each country to reach 60 participants. The sample included 30 students, 15 teachers, and 15 parents. The participants were interviewed in which they offered their lived experiences during the pandemic. The researchers also observed 60 online classes including four classes for each teacher.

The interviews were conducted via Zoom and each interview session lasted for 20-30 minutes. Observations lasted for 50 hours. The interview data were transcribed and analyzed using thematic analysis. They analyzed the observation through documenting the class structure and audio-recording class sessions. The findings show that the quality of the learning content delivered remotely during the Covid-19 emergencies was low compared to content delivered in well-planned online sessions. Digital inequity also influenced online learning during Covid-19 negatively as disadvantaged students in remote locations lacked the required technological resources to access lessons.

Ridge & Erfurth (2020) also examined the impact of the Covid-19 pandemic on the education sector in the UAE. The researchers highlight the unprecedented nature of the school closures across the world following the pandemic and the struggles by

governments and school systems to ensure educational continuity for all students. Consequently, the researchers conducted their study intending to provide additional data regarding the impact of Covid-19 on local students besides other educational stakeholders in the United Arabs Emirates. The researchers used a quantitative methodology in which they used online surveys to collect data. Specifically, the study was conducted in mid-April 2020 within two weeks. The study sample included 700 participants composed of public and private school students, parents, teachers, and administrators. The composition of the participants includes 77% females and 23% males. Besides, half of the participants were UAE citizens. The rest comprised of Africans, North Americans, Europeans, and South Asians. The online survey had 49 open-and closed-ended questions. Besides the surveys, the researchers also conducted phone interviews with education experts.

The findings show that all stakeholders in the study lack formal training for remote learning and teaching. Regarding academic performance, students reported finding it challenging to interact with teachers, which affected their learning significantly. Students also experienced increased workloads per day on distance learning in which students in public schools spent 5.6 hours on average in online classes and another 3 hours for homework and preparation. The researchers concluded that distance learning due to Covid-19 is demanding for students. Besides, Covid-19 related school closures exposed students with special needs or learning disabilities to significant disadvantages due to lack of adequate support. The study also illustrates that the effect of Covid-19 on education is extensive in the UAE owing to the lack of free public education for all students and the divide between socioeconomic groups. In particular, disadvantaged students are highly likely to lack the required resources to access learning.

El Said (2021) conducted an empirical study about the academic performance of university students in Egypt to investigate the effect of Covid-19 on learning. The researcher identifies the sudden shifts to online learning globally and seeks to investigate the effect of this shift on learning. Thus, the researcher used a mixed-method methodology comprising of quantitative and qualitative methodology to investigate whether the academic performance of students differed between in-person and remote learning for the same course in different periods. Regarding the quantitative methodology, the researcher compared grade differences between in-person and online education to assess the academic performance of students. The grades were compared in four questions, mid-term examination, and final examination in which the independent variables included CGPA, credit hours, gender, and student level. The comparison period included spring 2019 for the in-person mode and spring 2020 for the remote learning mode during the pandemic. The researcher also assessed the satisfaction of students with distance learning using online surveys.

Regarding the qualitative methodology, the researcher used online interviews to evaluate the experience of instructors with remote learning. Additionally, the study sample comprised 748 students from Future University, Egypt. The remote learning sample included 372 students while the in-person sample included 376 students. The demographic distribution of the sample included 57% male ad 43% female. Regarding the interviews, four professors were interviewed.

The researchers operationalized academic performance using course grades in which they collected data about the grades for the two groups during the spring 2019-spring 2020 period. The researcher also posted the student satisfaction survey on the university portal in June 2020 to gather feedback from 435 students. The researcher compared grades for the two groups using t-tests while the distribution was analyzed

using chi-square tests. An assessment regarding the effect of CGPA, age, credit hours, and gender was also conducted. The researcher did not find any statistically significant differences in the grades of students. Besides, the sudden shift to distance learning did not lead to a poor learning experience.

Malik and Javed (2021) also identify the advantages of a well-planned e-learning model in terms of convenience and the challenges experienced when students shifted to online learning suddenly during the Covid-19 pandemic without proper planning. Thus, the researchers conducted a study to examine the effect of Covid-19 based e-learning on stress perceptions of students in Oman. They conducted their study at the University of Nizwa in Oman using a quantitative methodology in which data was collected using online self-administered questionnaires. The study sample included 966 students from various colleges. The researchers also used the perceived stress scales for assessing stress in which stressors could be academic, psychological, or social. The surveys were delivered via Google forms remotely to the participants using their university emails. It was a bilingual survey in English and Arabic. The survey was also included on the Moodle home page of the University to increase participation. The study was conducted from December 6 2020 to December 31 2020. The researchers also conducted a statistical analysis using the SPSS-20 software. The findings show that Covid-19 affected the mental health of students negatively. Female students experienced more stress symptoms than did male students. Besides, students from urban locations were more stressed than did students from remote locations. The researchers emphasized that high-stress levels among students are associated with reduced academic performance in which they found a negative association between the perceived academic performances of students with perceived stress.

Alshaikh et al. (2021) identify the potential adverse effects of Covid-19 on the

education process due to the imposed restrictions to curb the spread of the virus. Thus, the researchers conducted a study to investigate the effect of Covid-19 on the education process in Saudi Arabia. Another objective of the study was to examine the effect of the rapid changes on satisfaction among students in Saudi Arabian Universities. The researchers designed their study using the Technology-Organization-Environment Framework to examine the effectiveness of online learning during the Covid-19 crisis by identifying major aspects that affect the education process. The research is based on a quantitative methodology in which the researchers used online cross-sectional self-administered questionnaires for data collection. The study participants included fresh, undergraduate, and postgraduate students while the study was conducted during the 2020-2021 academic year in the first semester. Two open-ended questions were also included for data collection. The survey was designed with Google forms, consisted of Likert scale questions, and was administered via WhatsApp. The study sample also included 580 participants, who were recruited via WhatsApp groups. However, the researchers received responses from 150 participants.

The researchers found that the sudden changes in the education sector due to Covid-19 resulted in a smooth transition in the higher education sector since institutions were prepared for the shift towards distance learning. Nevertheless, students faced challenges concerning comprehending and focusing during learning compared to in-person sessions due to factors such as family circumstances, social status, and the surrounding environment. However, online learning offered students with more opportunities for completing assignments as they waited for lectures. The geographic distance had adverse effects on communication and performance during group work. Besides, students engaged in practical work did not benefit from online learning. Nonetheless, the researchers found that remote learning saved time, as students are not

required to travel, which offers students more time to study and complete assignments and projects, which enhances their academic performance.

Alban Conto et al. (2021) investigated the extent to which Covid-19 caused school disruptions affected the acquisition of foundation skills among students to understand the effects of Covid-19 on learning. The methodology used for the study included two surveys conducted in various countries. The first survey included the MICS6 survey that contained the foundational learning skills module data that captured learning within and outside the school for grade two students. The data was acquired before the pandemic from 13 countries including Zimbabwe, Sierra Leone, Pakistan, Nepal, Mongolia, Madagascar, Lesotho, Guinea Bissau, Ghana, Ghana, D.R. Congo, Chad, Central African Republic and Bangladesh. The survey measured the association between foundational learning and school attendance. The second survey included the UNESCO-World Bank-UNICEF survey data from various Ministries of Education from 122 countries during the first round and 149 countries during the second round. The second survey was conducted during the pandemic and was intended to understand the effect of remote learning models on learning. The researchers conducted regression analysis on the data to capture the learning difference of missing at least a school year. The findings show that students who did not access online education missed up to one school year, which affected their knowledge acquisition negatively. School closures had adverse effects on marginalized students, which affected their academic achievement significantly.

Fazza & Mahgoub (2021) approached the effect of Covid-19 on academic achievement topic by focusing on its effect on student engagement to identify challenges to student engagement in distance learning in Qatar. The researchers used the community of inquiry model to investigate the learning settings. An exploratory

qualitative methodology with a focus on the case study strategy was used. The study was conducted at Georgetown University in Qatar in which data collection occurred through an online qualitative and structured questionnaire comprising of open-ended questions. The questionnaire consisted of seven questions. Purposive sampling was used to select 244 participants even though only 64 participants received the questionnaire. The questionnaires were delivered via email addresses using Google forms and 13 participants completed the questionnaires before the researchers analyzed the data using thematic analysis. The findings show that the major challenges experienced during online learning include an uncomfortable learning environment, absence of distinct impressions of classmates, technical issues with the internet or devices, absence of conversions online, feeling uncomfortable engaging in group discussions online, absence of peer feedback and correction, and inability to understand views of other students. These challenges affected engagement during learning negatively, which may cause some students to drop out of the class. In turn, this results in poor academic performance.

Eze et al. (2021) examine the effect of the impact of the Covid-19 pandemic on primary and secondary schools in Nigeria. The researchers identify the unique situation of the students and schools in Nigeria such as students not being allowed to own digital devices at school and the education system adopting purely in-person practices. Thus, the pandemic posed significant challenges to the education system. The objective of the study was to explore the views of educational stakeholders regarding the Covid-19 challenges and the effect of the challenges on learning in primary and secondary schools. The researchers used a sequential exploratory mixed methods study design including both quantitative and qualitative methodologies. Data for the qualitative phase was collected using semi-structured interviews from 18 participants comprising

of five education policymakers, six school head teachers, and seven principals. Thematic analysis was used to analyze interview data. The researchers also used the phase one data to inform data for the second phase before merging the results using integrated interpretation. The study sampled 5,552 participants including the 18 participants who participated in the interviews. Purposive sampling was used to select the interview participants before using the snowball sampling to select the remaining 5,534 participants of which 4,933 completed the online Covid-19 impact on education questionnaires. The participants were composed of 2,360 students, 1,798 teachers, and 1,880 parents and were spread across 36 states. The findings show that Covid-19 resulted in poor learning and unequal or poor access to learning opportunities. The pandemic also widened the achievement gap and inequality in learning.

Melzer (2021) also investigates the impact of Covid-19 on students in America due to its disruptions of school routines among high school students. The objective of the study was to investigate the way Covid-19 is related to individual student-level factors. Specifically, the researcher identified the factors from previous studies before developing a model to predict student academic achievement of students. The differences in realized and predicted scores were then used to identify student factors that are associated with Covid-academic achievement impact (Covid-AAI). The study occurred at Midwest high school and middle school in the 2015-2016 and 2020-2021 period including grades 5-11. The participants included 400 participants, 3,623 reading tests, and 3,600 mathematics tests. The researcher measured the Covid-AAI using the Northwest Evaluation Association MAP Growth Assessments data. The researcher also collected data from student test scores during the two academic years and used the Rasch unIT (RIT) scale scores of the students of 2016-2017 to 2019-2020 to predict the anticipated score achievement of students based on past trajectories and on the

assumption that the students would maintain their score trajectories into the pandemic period. The researcher then used the differences in scores predicted for individual learners and the real scores received on the tests in 2021 to compute Covid-AAI for 414 students who participated in the tests. The researcher also considered factors such as absences, socioeconomic status, ethnicity/race, gender, and grade point average when developing the model. The findings show that even though Covid-19 result in low academic performance for average students, the pandemic did not affect academic performance significantly. The researcher suggested that some high schools were resilient to the effects of Covid-19. Specifically, technologically perceptive high school students can regulate their learning and can access numerous social outlets compared to young students. Other factors that helped the students to remain resilient include earlier exposure to tutoring and after school events before the pandemic, which may have mitigated achievement losses. However, students with low socioeconomic statuses had a low academic performance.

Ferreira (2020) conducted a descriptive study to explore student achievement, instructional hours, teacher preparation, and student attendance levels for students in grades 1-8. The researcher conducted the study at an administrative unit of a school in New Hampshire during the three terms of the 2019-2020 academic year. A sample of 1,370 students, 95 teachers were recruited for the study. Pre-covid-19 student scores and attendance levels were compared to post-Covid-19 datasets in which the researcher compared the data from the first two terms during in-person learning with the third term during distance learning. A case study design was used to understand the unique responses of students to the pandemic. The data for the study was archival and came from the New Hampshire school administrative unit for the 2019-2020 academic year in which student achievement data was obtained from the PowerSchool student

information system for the 2019-2020 academic year. Data from teachers was obtained using surveys based on Google forms while student attendance data was obtained from the PowerSchool student information system and teacher surveys. The researcher computed mean and median scores of the three datasets and during the three terms. Standard deviations were also computed on the mean and median scores to identify data variability. The researcher also measured percentile ranking and Z-scores of the data. The results show that student achievement did not differ significantly for the three terms based on competency grades. Nevertheless, students attained high assessment grades during the first two terms than they did during the third term. Teachers also worked for fewer hours in the third term compared with the first two terms. The researcher also highlighted the role of equity regarding disadvantaged groups during the pandemic. In particular, the Covid-19 had a disproportionate effect on disadvantaged groups.

The aforementioned studies illustrate that even though students had different experiences, Covid-19 affected the academic performance of many students negatively. A study by the National Education Association and the National Parent Teacher Association used focus groups with 1,300 students to examine the effect of the pandemic on student performance (NEA & PTA, 2020). The age of the students ranged from 13 years to 18 years old and included students from urban, rural, and suburban areas in addition to students of color. The researchers adopted a qualitative study with focus group discussions before quantifying the results using online surveys with 1,328 students from public schools. The findings show that Covid-19 harmed schoolwork, which led to reduced academic progress. Specifically, while 58% of the students performed well academically before the pandemic, only 32% of them reported performing well during the pandemic. The self-reported decrease in academic performance was consistent among different groups of students regardless of the

learning model such as online-only, hybrid model and in-person learning. Nevertheless, young students, students from families without a college education, and students using the hybrid model were affected disproportionately.

In another study to examine the impact of the pandemic on learning, Ariyanti and Santoso (2020) investigated the differences in student performance in mathematics before and after the pandemic. The researchers researched two senior high schools in Madium, Indonesia. They used a quantitative research methodology with a focus on the one-group pretest-posttest design for comparing performance before and after the pandemic. They recruited 96 students using a non-random sampling technique before collecting data from the students' using questionnaires and documentation. They also used a paired sample test and the population normality test based on the SPSS program. The results show that on average, students performed well in mathematics before the pandemic than they did after the pandemic. Besides, students responded positively to mathematics before the pandemic than they did after the pandemic. Reduced student performance was due to factors such as interference at home when engaging in online learning, technical problems such as weak internet signals, limited quota, and lack of explanations from teachers when giving questions.

2.2. Summary

Overall, the literature review demonstrates that Covid-19 had significant negative effects on academic performance. In particular, the pandemic effect on academic performance was due to factors such as inability to interact with classmates and the teacher, technical issues that interfered with learning, and disruptions from the surroundings when attending lessons. Practical subjects suffered significantly owing to their emphasis on physical presence. Besides, the negative effects of the pandemic on academic performance were particularly significant for disadvantaged students such as

those with a low socioeconomic status background, and those from rural or remote locations. The review shows that the disproportionate effect on disadvantaged groups was due to their inability to access the required technological tools such as the internet and the associated devices that would enable them to attend online classes.

Besides, younger students were affected disproportionately than did older students due to factors such as the familiarity of older students with technology. However, some students were found to be resilient to the effects of the pandemic. For these students, their resilience arises from earlier programs implemented in their schools such as community learning and after school programs. Besides, some technologically perceptive students were resilient to the adverse effects of the pandemic because of their ability to regulate their learning and access social outlets compared. There was also a noticeable gap regarding the studies, especially studies from the Middle East and Qatar. In particular, a majority of the studies in the aforementioned locations about the topic focus on the higher education sector. Thus, it is crucial to examine the effect of Covid-19 in the secondary school level in Qatar to compare the results.

2.3. Hypothesis

In the current research, several hypotheses are formulated as below:

- There is a relationship between student characteristics such as gender, age group, nationality, year of study, and the selection of academic discipline.

- There is a relationship between student' GPA in art and science courses, and the selection of academic discipline.

- There is a relationship between student characteristics such as gender, age group, nationality, year of study, academic discipline, and student' GPA in art and science courses.

CHAPTER 3: METHODOLOGY

As mentioned earlier, the primary objective of this study is to identify factors affecting the academic performance of grade 12 students in Qatar. The study also investigates the factors that affect the students' academic major selection. The current chapter aims to establish the research methodology that was utilized in the study. It covers the population of the study, the study sample, and its characteristics including cluster sampling and the sampling procedures. The chapter also highlights the data analysis procedures used during the study which includes Chi-Square Test that helps in examining if two categorical variables are related, the logistic regression, and the multivariate analysis of variance (MANOVA).

3.1. Study population

Qatar education is highly diverse. It comprises several schools that represent a variety of international curriculum systems. The schools, both private and public schools have many students who undergo the primary, secondary, and tertiary levels of education. The study focuses on grade 12 students in public secondary schools in Qatar. According to the annual statistics report from the Ministry of Education and higher education website, there are 67 public secondary schools in Qatar (Ministry of Education, 2021). The report also indicates that the number of grade 12 students in these public secondary schools in the 2019-2020 academic year is 9073. This population forms the basis of this study as it aims to determine the impact of the COVID-19 outbreak on the students' academic performance and factors that affect the student's academic major selection. The 67 public secondary schools in Qatar have different learning resources with every school having unique problems to address.

3.2. Study sample and characteristics

Sampling is an essential step in performing a study. It is among the most essential factors that help in determining the accuracy of the research study results. Several sampling techniques help in gathering the sample population based on the need and situation. The current study has utilized a one-stage cluster sampling method to select the population to use in the study.

3.2.1. Cluster sampling

It refers to a probability sampling method that categorizes population elements into mutually exhaustive and exclusive groups referred to as clusters. Research then collects the clusters for sampling where some or all elements of the selected clusters represent the sample. Cluster sampling is applicable in the study of large populations, especially those that are widely dispersed in different geographical locations (Chaabane et al., 2021). The most common clusters researchers use are cities and schools, which are pre-existing units. In this sampling technique, researchers divide a large population into clusters (smaller groups), and then select randomly from the elements of the cluster to form a sample (Chaabane et al., 2021). There are three different types of cluster sampling as shown in figure 1. These are single-stage, two-space, and multi-stage cluster sampling. Single-stage cluster sampling involves four main steps.
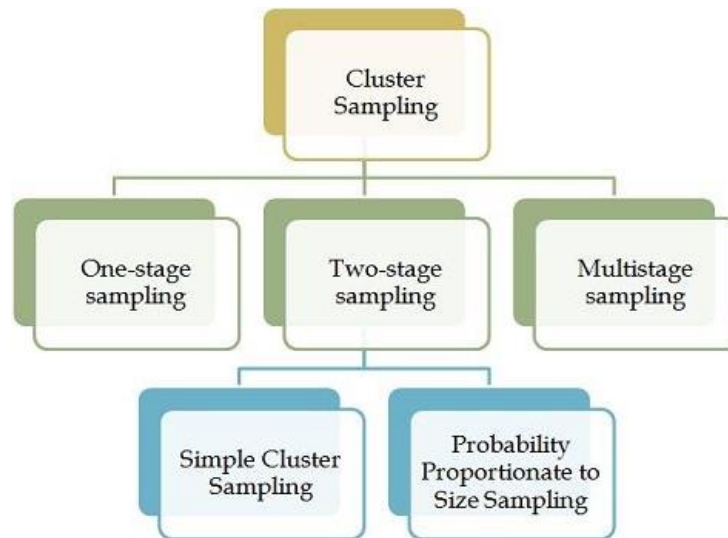
Figure 1. Types and the sub-types of cluster sampling

The first step is the definition of the population to give a clear picture of the study population and its characteristics. The second step in single-stage cluster sampling is the division of samples into clusters. This step is the most crucial part of cluster sampling (Chaabane et al., 2021). The quality of clusters and the kind of representation they give larger population determines the validity of the results. The third step is the random selection of clusters to use as samples. The fourth and final step of single-stage cluster sampling is the collection of data from samples randomly selected (Azevedo et al., 2021). The other type of cluster sampling, multi-stage cluster sampling involves the random selection of individual units within clusters to utilize as samples.

3.2.2. Sampling procedure

For this research study, we randomly draw 8 schools out of 67 clusters of secondary schools. Grade 12 students from these four schools were then used as the sample for the current study. The data of all grade 12 students from the randomly selected eight schools was be obtained from the ministry of education. The data set will be obtained from the 8 school clusters that were selected randomly. From four of them, we obtained

pre-COVID 19 data and from another four schools, we obtained post-COVID 19 data. The pre-COVID 19 data was crucial as it acted as the benchmark for determining the magnitude of COVID-19 impact on the academic performance of grade 12 students. On the other hand, post-COVID-19 data was used to compare to that obtained from pre-COVID-19 to evaluate the impact of the pandemic and other factors on academic performance.

The data collection procedure focused on obtaining crucial information of the students such as their age, gender, nationality, academic discipline, final grade of different subjects, and GPA. Researchers used this data to achieve the main objective of the research including determining the factors that affect the students' academic major selection and identifying factors affecting the academic performance of grade 12 students in Qatar.

3.2.3. Sample characteristics

The sample characteristics of this study entail school-going children of grade 12. According to Table 1, the students are of different nationalities grouped as Qatari nationals (512 students, 36.31%) and non-Qatari nationals (898 students accounting for 63.69% of the sample size). Non-Qatari nationals are foreign students of any nationality learning in Qatari public secondary schools. The sample characteristic also includes gender classified as female and male. The female students in this study amount to 50.35% which is 710 female students and 700 male students, accounting for 49.65% of the entire sample size. Another characteristic of the sample study is the age group. The sample study has two age groups, those below 19 years of age and those above 19 years of age. The study focuses more on those students below 19 years which accounts for 84.47% (1191) of the total sample size while those above 19 years are 219, accounting for 15.53%.

Table 1. Sample characteristic

Characteristic		N	Percentage (%)
Gender	Female	710	50.35%
	Male	700	49.65%
Group	Pre-COVID	762	54.04%
	Post-COVID	648	45.96%
Nationality	Non-Qatari	898	63.69%
	Qatari	512	36.31%
Age Group	19 or below	1191	84.47%
	Above 19 years	219	15.53%
Discipline	Art	826	58.58%
	Science	584	41.42%
Total		1410	100.00%

The study sample also has the group characteristic where students are grouped into two categories. The study was done on students before the pandemic and after the pandemic to clearly understand the impact of COVID-19 on the academic performance of students. Much of the study was done on students before the pandemic with 762 students drawn from pre-COVID data. 648 students were from post-COVID-19 accounting for 45.96% of the total sample size. The 826 students (58.58%) were of Arts discipline while 584 students (41.42%) were from the Science discipline. Comparative analysis was then done to determine which subject was most affected by the pandemic.

3.3. Data analysis procedures

Processing of data analysis was done using SPSS (Statistical Package for Social Sciences) version 24. Various descriptive statistics including the mean, standard deviation, percentage, and frequency were calculated and reported. Hypothesis testing was done using various methods. These methods include Chi-square test for independence, Logistic regression, and Multivariate analysis of variance (MANOVA). These hypothetical testing techniques were used to determine the factors that affect the

students' academic disciple selection and their academic performance. Every hypothetical test method is elaborated in the subsections below.

3.3.1. Chi-Square test

The Chi-square test is used to examine whether two categorical variables are related to each other or are independent. The value of one variable does not affect the probability distribution of another if the two categorical variables are independent. However, the probability distribution value of one variable depends on the other if the two categorical variables are related. The Chi-square test evaluates the differences in the conditional distribution observations of one variable across levels of other variables (Yockey, 2017). It then compares the observed conditional distribution to the overall or marginal distribution of the variable. This test uses two types of distribution: marginal and conditional distribution. A conditional distribution refers to the distribution of a variable's all levels provided the other variable has equality in some values (Yockey, 2017). Marginal distribution, on the other hand, refers to the overall distribution of one variable irrespective of other variables.

The Chi-Square test statistic for the independence is calculated using the formula;

$$\chi2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(Oij - eij)^2}{eij} \quad (1)$$

In the above formula, Oij is the observed cell count within column j and row i of the table. The eij is the expected cell count within column j and row i of the table. This test determines if the difference between marginal and conditional distributions is significant. It further determines if the differences between the two distributions are

insignificant that they can be expected by random chance. The Chi-square test of independence has three major assumptions that must be applied during its use. The three assumptions are independent observations, random samples, and a large sample size that accommodates all expected frequencies greater than 1 while more than 80% of the expected frequencies are greater than 5 (Yockey, 2017). The use of the chi-square test of independence involves both null hypothesis and alternate hypothesis.

3.3.2. Logistic regression

Logistic regression is a statistical analysis tool suitable for use in binary dependent variables. Binary dependent variables also mean dichotomous dependent variables. This type of analysis is a predictive analysis method that describes data. Logistic regression data analysis technique also explains the relationship between a dependent binary variable and a single or more interval/ratio, ordinal, or nominal level independent variables (Monfort, 2014). Most of the logistic regressions are hard to interpret due to their complexity. However, with the use of the Intellectus Statistics tool, a researcher can analyze the data and then interpret the output in English. Most of the questions in binary logistic regression analysis involve yes versus no answers to give it the dichotomous aspect.

The formula below is used for logistic regression. In the formula, the odd ratio is $\frac{p}{1-p}$. When the log ratio is positive, the probability of success is often higher than 50%.

$$\log\left(\frac{p}{1-p}\right) = B_0 + B_1 x_1 + B_2 x_2 + \cdots + B_k x_k \quad (2).$$

The application of logistic regression statistical analysis tool involves making some assumptions as well. This method has three key assumptions to apply while using

it. The first assumption is that the dependent variable is dichotomous or binary, for example, 'yes' versus no, present versus absent, etc. The second assumption of this method is that the data has no outliers. Assessment of data outliers is through conversion of continuous predictors to standardized scores and then elimination of values greater than 3.29 or those below -3.29 (Monfort, 2014). The final assumption of this method is that there are no high correlations among the predictors. Assessment of multicollinearity of high correlation is through correlation matrix. The acceptable correlation coefficient of independent variables should be less than 0.90 (Monfort, 2014).

The AIC means Akaike's Information Criteria and the BIC means Bayesian Information Criteria. The AIC is a measure of the quality of fit of any statistical model that has been calculated. The BIC is a method of selecting a model from a group of parametric models with varying amounts of parameters. Though these two terms address model selection, they are not the same. One can come across may difference between the two approaches of model selection (Prabhat, 2010).

3.3.3. Multivariate analysis of variance (MANOVA)

MANOVA is an extension of ANOVA (univariate analysis of variance). ANOVA analyzes the statistical differences of one continuous dependent variable using an independent grouping variable. MANOVA on the other hand extends the analysis by considering numerous continuous dependent variables (Denis, 2020). It then combines into a composite variable or weighted linear combination. MANOVA method compares if the newly formed combinations differ by independent variables, levels, or different groups. The method, therefore, tests whether an independent grouping variable can simultaneously explain the statistical significance of variance in an independent

variable (Denis, 2020).

Like any other statistical data analysis tool, MANOVA has its assumptions that must be applied for it to be effective during use. This method has five assumptions as outlined below. The first assumption of MANOVA is independent random sampling. This technique assumes that observations are independent and that there is no specific pattern for selecting samples, and the samples are completely random (Denis, 2020). Another assumption of this method is that the dependent variables are scale variables of continuous while the independent variables are categorical. The third assumption of the MANOVA technique is the absence of multicollinearity. MANOVA technique also assumes that there is multivariate normality in the data (Denis, 2020). The last assumption of this technique is on the homogeneity of variance where the method assumes equality in the variance between groups.

CHAPTER 4: ANALYSIS AND RESULTS

The current chapter reports the main findings of the analysis described earlier. This chapter is mainly divided into two main sections. The first section reports the results related to the first research question; what factors affect the grade 12 students' academic discipline selection. The second section reports on the findings associated with the second research question; What factors affect the academic performance of grade 12 students in Qatar.

4.1. Factors affecting the students' academic discipline selection

The chi-square test and logistic regression approach were applied to investigate the factors affecting grade 12 students' academic discipline selection. Table 2 shows various students characteristics varying with academic discipline selection.

Table 2. Student characteristics across the academic discipline

Variables		Academic Discipline		Chi-square	p-value
		Art	Science		
Time	Before Pandemic	463 (60.8%)	299 (39.2%)	3.25	0.07
	During Pandemic	363 (56.0%)	285 (44.0%)		
Gender	Female	473 (66.6%)	237 (33.4%)	38.08	< 0.01
	Male	353 (50.4%)	347 (49.6%)		
Nationality	Non-Qatari	364 (40.5%)	534 (59.5%)	331.96	< 0.01
	Qatari	462 (90.2%)	50 (9.8%)		
Age Group	Above 19	195 (89.0%)	24 (11.0%)	99.14	< 0.01
	19 and below	631 (53.0%)	560 (47.0%)		

We observe that in 2019, before the COVID-19 pandemic, the percentage of arts and science students were 60.8% and 39.2%, respectively. In 2020, during the COVID-19 pandemic, those percentages were 56% for art students and 44% for science students. The Chi-square test show insignificant results at the level of 0.05 (Chi-square

= 3.25; p-value = 0.07). Regarding students' gender, around one-third (33.4%) of female students selected the science major, while for male students, around half (49.6%) selected the science major. On the other hand, 66.6% of female students selected the art major while 50.4% of males selected the art major. The Chi-square test show significant results at the level of 0.05 (Chi-square = 38.08; p-value < 0.01). Considering students nationality, the percentage of Qataris who selected science major was 9.8%. On the other hand, non-Qataris who selected science major was 59.5%. The Chi-square test show significant results at the level of 0.05 (Chi-square = 331.96; p-value < 0.01). Considering the age group, only 11% of elder students selected science major, while for younger students, this percentage was higher (47%). On the other hand, 89% of the older students selected the art major while this percentage was 53% for younger students. Finally, the Chi-square test show significant results at the level of 0.05 (Chi-square = 99.14; p-value < 0.01).

To further understand the relationship and dependence that the different variables have on academic discipline selection, two logistic regression models (main effects and reduced main effects model) were created to predict the likelihood of academic discipline selection. Table 2 shows the odds ratios and p-values from the two models.

Table 3. Full main effects and reduced main effects logistic regression models

Estimates	Full Main Effects Model		Reduced Main Effects Model	
	OR	p-value	OR	p-value
Constant	0.00	< 0.01	0.00	<0.01
Time (During Covid) Pre-Covid	0.95	0.75	-	-
Gender (Female) Male	0.48	< 0.01	0.48	< 0.01
Nationality (non-Qatari) Qatari	7.28	< 0.01	7.27	< 0.01
Age Group (Above 19) 19 and below	0.35	< 0.01	0.34	< 0.01
Art courses GPA	1.23	< 0.01	1.24	< 0.01
Science courses GPA	1.12	< 0.01	1.12	< 0.01
AIC	1026.91		1024.93	
BIC	1063.58		1056.43	
Nagelkerke R Square	63.60%		63.50%	
Hosmer and Lemeshow Test	Chi-square = 10.69; df = 8; p-value = 0.22		Chi-square = 9.73; df = 8; p-value = 0.29	
Correct Classification Rate	84.30%		84.50%	

The AIC and BIC for the main effects model were 1026.91 and 1063.58, respectively, which are substantially higher than the AIC values from the reduced main effects models. Both models have similar Nagelkerke R-square values and correct classification rates. The Nagelkerke R-Square values for the full main effect model were slightly higher than the reduced main effect model. On the other hand, the correct classification rate for the reduced model was slightly higher than the full main effect model. Deviance (value \df) for full main effect model and re the reduced main effects models (0.726 and 0.728). According to Hosmer and Lemeshow Test (p-values > 0.05).

The time variable was found to not significantly affect the academic discipline selection. This variable was ignored in building the final reduced model. The odd of selecting the science major for female students was 52% lower when compared to male

students (OR = 0.48, p-value < 0.01). Moreover, the odds of selecting the science major for non-Qatari students was higher up to 7.27 times when compared to Qatari students (OR = 2.27, p-value < 0.01). Concerning the student's age group, the odds of selecting the science major for above 19 years students was 66% lower when compared to younger students aged below 19 (OR = 0.34, p-value < 0.01). Finally, when the art courses GPA increases by one per cent, the likelihood of selecting the science major will increase by 1.23 (OR = 1.23, p-value < 0.01). Similarly, when the science courses GPA increases by one per cent, the likelihood of selecting the science major will increase by 1.12 (OR = 1.12, p-value < 0.01).

4.2. Factors affecting students' academic performance

The multivariate analysis of variance (MANOVA) examined the relationship between several independent variables and students' academic performance in art and science courses. Table 4 show multivariate test results using several test statistics.

Table 4. Multivariate tests results

Effect	Test Statistic	Value	F	Hypothesis df	Error df	p-value
Intercept	Pillai's Trace	0.94	11702.82	2	1403	< 0.01
	Wilks' Lambda	0.06				
	Hotelling's Trace	16.68				
	Roy's Largest Root	16.68				
Time period	Pillai's Trace	0.04	28.58	2	1403	< 0.01
	Wilks' Lambda	0.96				
	Hotelling's Trace	0.04				
	Roy's Largest Root	0.04				
Gender	Pillai's Trace	0.05	36.13	2	1403	< 0.01
	Wilks' Lambda	0.95				
	Hotelling's Trace	0.05				
	Roy's Largest Root	0.05				
Nationality	Pillai's Trace	0.02	11.89	2	1403	< 0.01
	Wilks' Lambda	0.98				
	Hotelling's Trace	0.02				
	Roy's Largest Root	0.02				
Discipline	Pillai's Trace	0.27	262.98	2	1403	< 0.01
	Wilks' Lambda	0.73				
	Hotelling's Trace	0.38				
	Roy's Largest Root	0.38				
Age Group	Pillai's Trace	0.11	84.48	2	1403	< 0.01
	Wilks' Lambda	0.89				
	Hotelling's Trace	0.12				
	Roy's Largest Root	0.12				

Box's Test: Box's M = 299.26; F-value = 3.58, df1 = 78; df2 = 8376.43; p-value = 0

According to the results, the four multivariate tests provide the same conclusions. However, according to Box's Test for the equality of covariance matrices, the observed covariance matrices of the dependent variables are not equal across groups. Since this assumption is violated, Pillai's trace criterion is considered in this situation. Based on Pillai's trace criterion, all independent variables significantly affect one (or both) dependent variables (Art courses GPA and Science courses GPA). In particular, there was a statistically significant difference in academic performance based on the time period variable (F $(2,1403)$ = 28.58, p < 0.01; Pillai's Trace = 0.04). Based on gender variable, there was a statistically significant difference in academic performance among male and female students (F $(2,1403)$ = 36.13, p < 0.01; Pillai's

Trace = 0.05). Similarly, taking into account the students nationality, there was a statistically significant difference in academic performance among Qatari and non-Qatari students (F (2,1403) = 11.89, p < 0.01; Pillai's Trace = 0.02). Also, discipline had a significant influence on academic performance. The results show that there was a statistically significant difference in academic performance between Arts and science students (F (2,1403) = 262.98, p < 0.01; Pillai's Trace = 0.27). Finally, there was a statistically significant difference in academic performance between students aged below 19 years and other students (F (2,1403) = 84.48, p < 0.01; Pillai's Trace = 0.11). The next step is to use the univariate ANOVA to determine which variables and factors are causing the significance. Table 5 shows the results conducted from univariate ANOVA tests.

Table 5. Univariate ANOVA tests

Source	Dependent variables	df	F-value	p-value
Overall Model	Art Courses GPA	5	203.92	< 0.01
	Science Courses GPA	5	90.96	< 0.01
Intercept	Art Courses GPA	1	22860.63	< 0.01
	Science Courses GPA	1	12770.20	< 0.01
Time period	Art Courses GPA	1	21.56	< 0.01
	Science Courses GPA	1	51.36	< 0.01
Gender	Art Courses GPA	1	66.32	< 0.01
	Science Courses GPA	1	66.28	< 0.01
Nationality	Art Courses GPA	1	16.88	< 0.01
	Science Courses GPA	1	3.90	0.04
Age Group	Art Courses GPA	1	167.35	< 0.01
	Science Courses GPA	1	132.60	< 0.01
Discipline	Art Courses GPA	1	381.84	< 0.01
	Science Courses GPA	1	93.33	< 0.01
Error	Art Courses GPA	1404		
	Science Courses GPA	1404		
Total	Art Courses GPA	1409		
	Science Courses GPA	1409		

According to Table 5, the time period has statistically significant effect on art courses GPA (F = (1,1404) = 21.56, p < 0.01) and science courses GPA (F = (1,1404)

= 51.36, p < 0.01). Moreover, there is significant association between students' gender and both art courses GPA (F = (1,1404) = 66.32, p < 0.01) and science courses GPA (F = (1,1404) = 66.28, p < 0.01). Students' nationality also effects both art courses GPA (F = (1,1404) = 16.88, p < 0.01) and science courses GPA (F = (1,1404) = 3.90, p = 0.04). Also, there is a significant association between the age group and students' performance on art (F = (1,1404) = 167.35, p < 0.01) and science courses (F = (1,1404) = 132.60, p < 0.01). Finally, the result shows significant relationship between the academic discipline and both art courses GPA (F = (1,1404) = 381.84, p < 0.01) and science courses GPA (F = (1,1404) = 93.33, p < 0.01). All these significant ANOVAs are followed up with descriptive statistics, as shown below in Table 6.

Table 6. Descriptive statistics across different factors

Independent Variables		Art Courses GPA		Science Courses GPA	
		Mean	SD	Mean	SD
Time period	Pre-Covid19	78.47	15.20	78.70	16.55
	During Covid-19	76.75	16.95	73.71	19.66
Gender	Female	78.95	14.88	79.27	15.48
	Male	76.38	17.06	73.51	20.21
Nationality	Non-Qatari	81.56	15.54	78.76	18.58
	Qatari	70.87	14.61	72.28	16.77
Age group	Above 19	62.42	14.24	61.90	17.39
	19 and below	80.48	14.73	79.08	17.07
Discipline	Art	70.22	14.62	71.48	17.52
	Science	88.22	11.39	83.39	16.85

According to Table 6, the mean of art courses GPA before Covid19 (78.47 ± 15.20) is higher than during the Covid-19 period (76.75 ± 16.95). Similarly, the mean science course GPA before Covid-19 (78.70 ± 16.55) was higher than during the Covid-19 period (73.71 ± 19.66). Female students had better performance than male students in art and science courses. The result shows that the mean of art courses GPA for females was 78.95 ± 14.88, while for male students was 76.38 ± 17.06, and the average

science course GPA for females was 79.27 ± 15.48, while for male students was 73.51 ± 20.21. Non-Qatari students perform better in art and science courses with a GPA of 81.56 ± 15.54 and 78.76 ± 18.58, respectively. On the other hand, for the Qatari students, the mean art and science courses GPA was 70.87 ± 14.61 and 72.28 ± 16.77, respectively. Moreover, students aged 19 and below had higher performance in both art courses (80.48 ± 14.73) and science courses (79.08 ± 17.07) than older students. The mean art course GPA for scholars above 19 years was 62.42 ±14.88, and the mean science course GPA was 61.90 ± 17.39. Finally, science students showed better performance than students who majored in art. Science students' art and science courses GPA was 88.22 ± 11.39 and 83.39 ± 16.85, respectively. On the other hand, the mean art course GPA was 70.22 ± 14.62, and the mean science course GPA was 71.48 ± 17.52 for art students.

CHAPTER 5: DISCUSSION AND CONCLUSION

The present project investigated the effect of covid-19 on the academic performance of secondary students in Qatar. In this chapter, the researcher highlights and discusses the main findings of the study.

5.1. Factors affecting the academic discipline selection

The first finding regarding factors related to academic discipline selection is that there is a relationship between gender and the selection of an academic discipline. Specifically, boys are likely to select science majors while girls focus more on the arts. Previous studies support the association between gender and academic discipline selection (Plante et al., 2018). The effect of gender arises mainly due to cultural stereotypes regarding gender that affect the interpersonal expectations of students about themselves. For example, societies that socialize boys to focus on masculine traits and activities influence them to avoid feminine activities. In contrast, girls are socialized to avoid masculine activities. Thus, students perceive that sciences are associated with masculinity traits while arts are associated with feminine traits (Hand et al., 2017). The judgment of students regarding their ability to address problems in a particular academic discipline is related strongly to their achievement in that discipline (Plante et al., 2018). In particular, the self-efficacy of students mediates the role of their experiences and gender on their self-concept concerning a specific discipline and, on their ability, to solve problems in that discipline. The performance concerning the discipline, self-concept, and self-efficacy of females and males differ based on the self-efficacy perceptions of the students. The reduced judgment of female students about their abilities regarding the science discipline results in negative self-concept and lower performance (Plante et al., 2018). Therefore, interpersonal expectations of students about specific academic discipline due to their self-concepts and self-expectations that

arise from the influence of teachers and parents influence their academic discipline selection.

For the second finding, the researcher found that the nationality of a student affects the selected academic discipline in which local students (Qatari students) select arts mainly compared to non-Qatari students who mainly select sciences. Various contextual and individual factors potentially affect the selection of academic discipline. For example, student individual attitudes and attributes such as motivation and educational aspiration influence academic discipline selection (Sellami et al., 2017). Specifically, seeking jobs in the public sector compel many Qataris to pursue arts-based disciplines. Compared to international students, local students expect to work in the public sector or in the business world. The international students, on the other hand, have fewer expectations about working in the public sector in Qatar and consider alternative disciplines such as the sciences (Sellami et al., 2017). Additionally, a prevailing belief in the Arab world is that young people are attracted to careers in the public sector or the business world, which potentially explains why only a few local students are interested in the science disciplines.

The researcher also found that age affects the selected academic discipline in which older students aged above 19 years old select the arts in most cases compared to younger students aged 19 years and below who mainly select sciences. In the data analysis, the grade 12 students were classified into two main group including above 19 and 19 and below. Usually, the normal age for grade 12 students is 18-19 or below. Students who are aged above 19 and are still in grade 12 are more likely to have failed on grade 12 or even before grade 12. Therefore, students above 19 years old have lower performance compared to others, which explains why they major in the arts, since it easier for them compared to science. Nevertheless, focusing on a specific major is a

dynamic process and is influenced by numerous factors. Examples of the factors include existing trends, career counselor, and individual choices. Still, teenagers are unstable in their academic discipline selection compared to older students. Besides, students of all age groups can change a major. Specifically, studies find that students aged 18 to 24 years old have a higher likelihood of changing their majors (Raza, 2016). Generally, young people adopt majors based on their willingness and individual choices. Besides, teenagers are attracted to fascinating academic fields such as computer science, engineering, and I.T. However, as young students explore other majors, they may develop new interests that can compel them to change their majors (Raza, 2016). Therefore, focusing on a specific major is not constant as students may change the major based on their abilities, interests, and willingness.

For the fourth finding, it was found that GPA affects academic discipline selection in which the likelihood of majoring in sciences increases as the GPA increases while the likelihood of majoring in the arts reduces as the GPA increases. In particular, students with a high GPA are prepared more academically concerning their test scores in science than are those with low GPA, which increases their potential for success in science majors (Radunzel et al., 2016). However, students who initially scored high GPAs and selected science majors switch to art majors once their GPAs reduces. The likelihood of completing a major successfully relies on factors such as being prepared adequately in a specific field such as arts or science and expressed interest in a specific academic field. In particular, students who are interested in an art or science discipline have a high likelihood of persisting and completing the selected major than are those without expressed interest (Radunzel et al., 2016). Besides, students who are prepared adequately in science disciplines are more likely to succeed in their selected science majors than are those less prepared. Nevertheless, success in science majors is related

directly to high GPAs (Radunzel et al., 2016). Overall, GPA influences future selection of a major in which students with high GPAs select science majors while students with low GPA select non-science majors. Students who select science majors also switch to non-science majors as their GPA reduces and vice versa.

The fifth finding demonstrates no relationship between the COVID-19 pandemic and academic discipline selection. However, the pandemic affected learning and academic performance of students (Engzell et al., 2021). In particular, the outbreak of the pandemic transformed in-person classrooms to online learning. The scenario was unexpected, and it changed the learning of students substantially. Students of all genders performed comparably in online learning even though academic performance relied on several factors including socio-economic background of the students, access to the required resources, age of students, and the home environment. Specifically, students from low socio-economic backgrounds lacked the required resources to access online learning, which influenced their academic performance negatively (Alban Conto et al., 2021). Besides, older students performed better than did younger students as they were more familiar with technology than did the younger students. Moreover, factors in the home environment such as regular interferences during learning affected academic performance negatively (Engzell et al., 2021). In terms of academic discipline, the pandemic had no influence in the student selection of specific disciplines such as arts or sciences. Rather, the pandemic influenced the way students learn. In particular, it was challenging for students with science majors to perform experiments online, which influenced their academic performance negatively. However, students in the arts majors performed better than did their counterparts from the science disciplines owing to the absence of numerous experiments that could require in-person presence (Alban Conto et al., 2021). Thus, the pandemic had no effect on academic discipline

selection but influenced the academic performance of students in various disciplines.

5.2. Factors affecting the academic performance

The first finding regarding the factors that influence the academic performance of students demonstrates a relationship between gender and academic performance. In particular, female students perform better than male students do in arts and sciences. While the traditional belief is that girls perform poorly in sciences and better in the arts, recent studies suggest that girls perform similar to boys or slightly better than do boys both in the sciences (Goulas et al., 2020). Concerning the arts, girls perform significantly better than do boys. Even though girls earn high scores in all subjects including the science subjects, boys perform generally better in sciences than do girls. Besides, students usually compare their academic weaknesses and strengths between disciplines and with their peers when selecting academic disciplines to focus on (Goulas et al., 2020). Nevertheless, both boys and girls are more likely to select another discipline even if they and their peers perform well in a specific field. Studies show that compared to boys, negative scores affect girls more when selecting feature disciplines. Thus, teachers play a vital role in encouraging and recognizing the academic strengths of individual students regardless of gender or peers (Goulas et al., 2020). Past studies demonstrate that the gender stereotypes among teachers regarding the ability of girls in science adversely affects the way girls perceive themselves (Carlana, 2019).

Secondly, the researcher found that Covid-19 pandemic has a negative relationship with academic performance. Specifically, overall, grade 12 students performed better and achieved higher GPAs in the arts and sciences before the pandemic than they did after the pandemic. These results demonstrate that Covid-19 has an adverse effect on the education sector because the unexpected trend that arose led to the loss of contact hours for students (Sintema, 2020). The effect was

disproportional for disadvantaged students, as they could not access online classes due to lack of e-learning resources. Thus, even though schools implemented online learning during the pandemic, the online learning modality did not benefit students significantly. However, online learning benefited some students, particularly those who used specific online-learning software for sciences and those who were familiar with online learning programs (van der Velde et al., 2021). Besides, online learning benefitted low performing students more than it did high-performing students concerning performance during the pandemic. Studies suggest that the good performance of low performing students was due to fewer distractions from other students in home learning environment (Spitzer & Musslick, 2021). Consequently, while the pandemic had general negative effects on student performance, it had positive effects on some students

For the third finding, the researcher found that the nationality of students influences their academic performance. In particular, Non-Qatari students perform better than Qatari students do in the arts and sciences. Regarding the gap between non-Qatari and Qatar students in school performance, the potential reason for the phenomenon is that Qatar is a rentier country. Specifically, in rentier societies, which includes the wider Arab Gulf, societal capacities among citizens are low, which results in high expectations from the resources of the state and low productivity (Hertog, 2010). While local students are not contributing to society yet, societal culture based on the rentier context fosters future expectations that influences the engagement and attitudes of students towards learning and school. Consequently, students grow up expecting that the state will offer assistance regardless of their individual contribution after leaving or completing school (Lee, 2016). In turn, the students end up believing that engaging with learning and school does not affect their life outcomes in the future, which

influences their attitudes, engagement, and motivations concerning learning adversely. In contrast, non-Qatari students expect their outcomes in school to affect their life outcomes in the future significantly.

Regarding the fourth finding, it was found that age affects academic performance in which young students aged 19 years and below perform better compared to do older students aged above 19 years in the arts and sciences. As aforementioned in the section regarding the association between age and academic discipline selection, grade 12 students are normally aged 18-19 years or below. Thus, older students above 19 in grade 12 may have performed poorly in grade 12 or before grade 12, which demonstrates the reason for their low performance and the decision to major in the arts. For them arts are considered to be easier than are the sciences. Younger students perform better compared to older students because of factors such as cognitive abilities. In particular, these abilities develop in young people before they start depleting as the students grow older, which on average occurs during the early twenties (Salthouse et al., 2004). Therefore, younger students benefit more from learning due to their young age. Additionally, younger students are usually less active socially in which they focus their time more on studying than do older students who are more active socially and spend less time on studying (Pellizzari & Billari, 2011). Consequently, younger students set aside adequate time for completing their homework, which in turn influences them to perform better than do older students who spend less time completing their homework.

The fifth finding shows that the selected academic discipline affects academic performance in which students majoring in the sciences perform better than do students majoring in the arts. Students taking the arts perform slightly better than do students in the sciences in specific course units. However, the difference is not statistically significant. Thus, Haolader et al. (2017) argues that science students attain better

academic performance than arts students do because science students have adequate academic background. In particular, science students perform better than do their arts counterparts because science students have a background in both the sciences and arts.

5.3. Conclusion

The study offered insights into the relevant factors influencing the academic performance of students during the Covid-19 pandemic. Based on the study findings the pandemic had a particularly significant effect on secondary school students in which it affected academic performance substantially. Relevant factors that affect academic discipline selection based on the current study include gender, nationality, age, and GPA. Factors that influence academic performance include nationality, age, gender, and academic discipline.

It is crucial for education stakeholders to understand the factors that affected the performance of students after the implementation of Covid-19 related measures as this may affect events in the future with a similar situation. Consequently, the study recommends that stakeholders in the education sector invest in developing digital competencies of both academic staff and students to prepare them for identical situations. In particular, education stakeholders including schools should strive to expose students and staff to relevant technologies that can contribute to learning. Increasing the familiarity of student and staff with various technologies can help them understand how to use the technologies positively to improve academic outcomes.

Future studies can organize countries based on the level of economic development owing to the role of technological development and access and affordability of the technology on the effectiveness of e-learning and student performance. In future, researchers should consider countries from all economic growth and development levels to investigate any differences in student performance with

distance learning. In turn, this may offer insights into areas to focus on for investment in the education infrastructure in less developed countries.

Besides, even though online learning was useful for the continued functioning of many schools during the pandemic and learning continuity, online learning does not address all the learning needs of work-based and practical learning such as technical or health and medical sciences in the long term. Future studies should emphasize student performance based on differences between study fields, especially concerning practical and theoretical education and the competencies that should be developed in online learning.

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Appendix A: Descriptive statistics of dependent variables

Table 7. Descriptive statistics of dependent variables

			Statistic	S.E
Art Courses	Mean		77.6766	.42736
	95% Confidence Interval for Mean	Lower Bound	76.8382	
		Upper Bound	78.5149	
	5% Trimmed Mean		78.5128	
	Median		79.7500	
	Variance		257.522	
	Std. Deviation		16.04749	
	Minimum		19.88	
	Maximum		100.00	
	Range		80.13	
	Interquartile Range		25.41	
	Skewness		-.612	.065
	Kurtosis		-.365	.130
Science Courses	Mean		76.4093	.48496
	95% Confidence Interval for Mean	Lower Bound	75.4580	
		Upper Bound	77.3606	
	5% Trimmed Mean		77.6401	
	Median		79.6250	
	Variance		331.616	
	Std. Deviation		18.21033	
	Minimum		15.00	
	Maximum		100.00	
	Range		85.00	
	Interquartile Range		26.00	
	Skewness		-.858	.065
	Kurtosis		.139	.130

Appendix B: Normality test of dependent variables

Table 8. Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Art Courses	.082	1410	.000	.947	1410	.000
Science Courses	.098	1410	.000	.928	1410	.000

a. Lilliefors Significance Correction

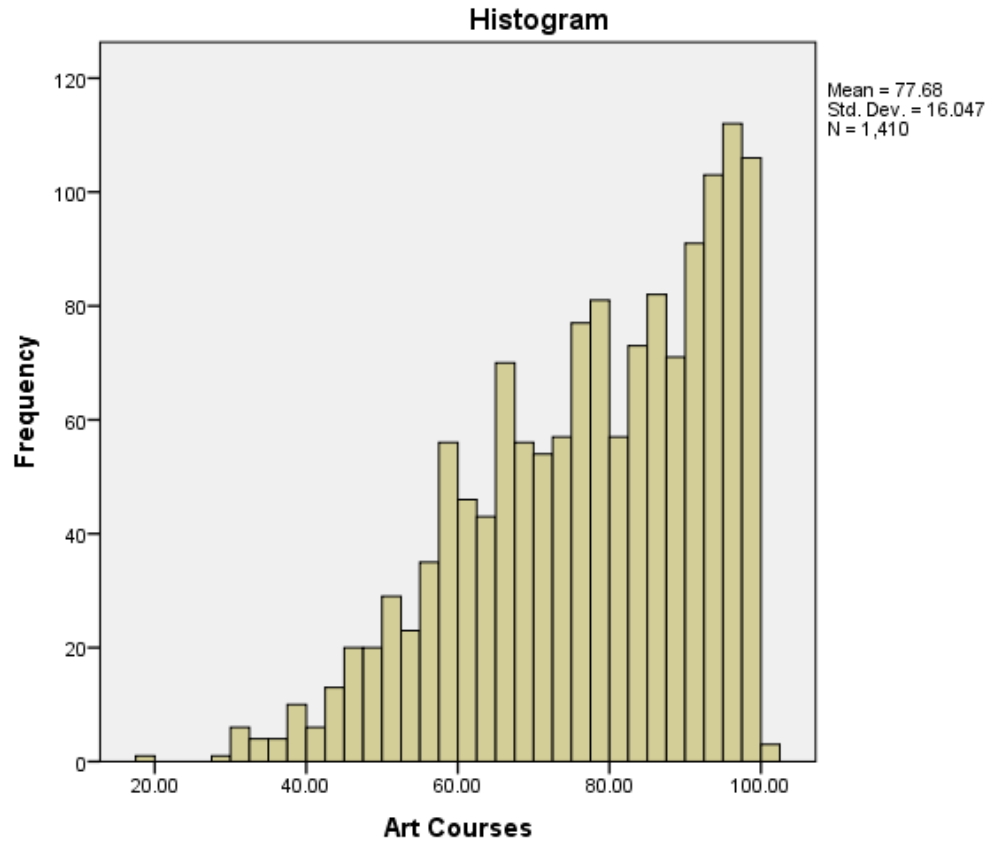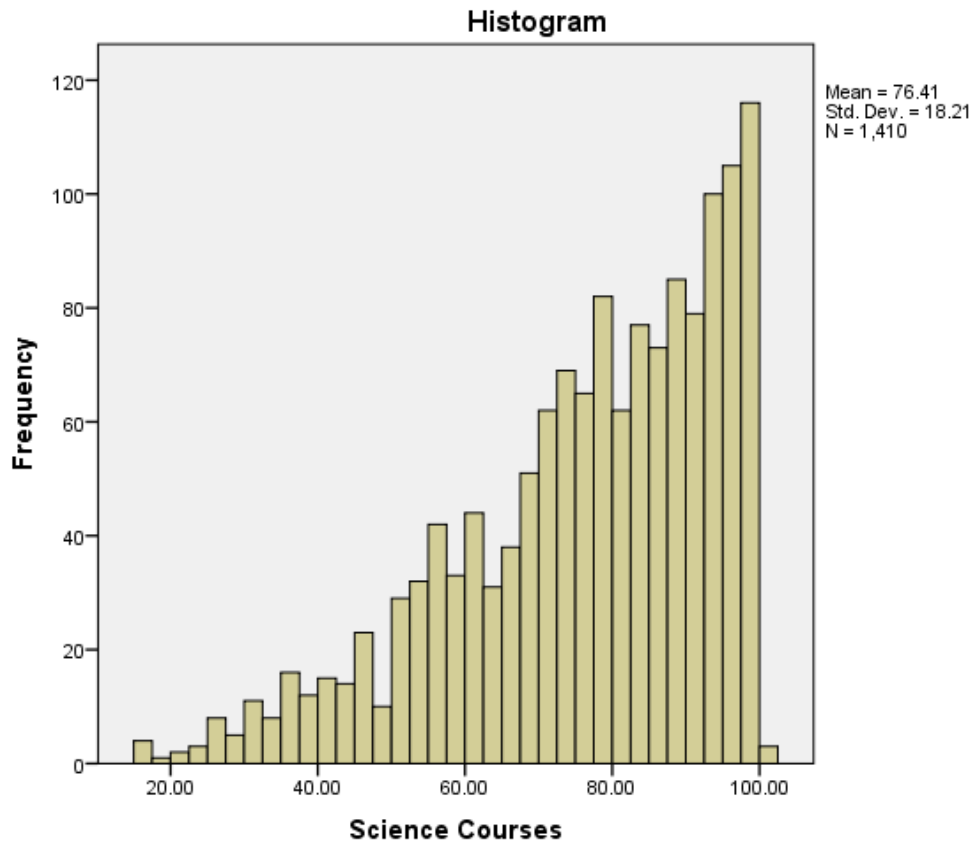**Appendix C: Distrbution of dependent variables**

Figure 2. Histogram of art courses GPA

Figure 3. Histogram of science courses GPA