Research

Navigating change: Assessing the influence of online teaching on academic performance in pharmacy cohorts during COVID-19

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Background. This study investigates the academic performance of three consecutive cohorts of pharmacy students, with a specific emphasis on admission criteria. The multifaceted admission policy allocates 40% of positions to the highest academic achievers, while the remaining 60% is distributed among top performers from quintiles 1&2, rural backgrounds, and students identified as top achievers within the black and coloured demographic. This classification framework facilitates a nuanced examination of academic performance variations across diverse admission parameters within the pharmacy student cohorts.

Objectives. This study sought to determine the influence of the transition to online learning on students' academic performance, taking into account different entrance categories, in the light of the circumstances imposed by the COVID-19 epidemic.

Methods. This retrospective study examines the academic trajectories of three cohorts of pharmacy students (N=358) enrolled from 2019 to 2021. The primary objective involves the analysis of each cohort's academic performance, employing admission data as a differentiating parameter, with the first-year progression outcome serving as the dependent variable. Subsequently, a comparative analysis of the three cohorts is conducted, utilising the first-year progression outcome as the dependent variable to discern nuanced differences.

Results. In 2019, academic performance among students with different admission categories was not statistically significant $F(2, 101)=2.697$, $p=0.072$. In the year 2020, there were notable disparities identified among different groups $F(3, 73)=13.627$, $p<0.001$. However, in the year 2021, no significant distinctions were found $F(3, 95)=0.490$, $p=0.690$. The results of the cohort-based analysis revealed significant performance variances $F(2, 277)=28.282$, $p<0.001$.

Conclusion. The results highlighted significant performance variances, underscoring the need for a nuanced approach to education. The transition to online learning, especially amid the challenges of the COVID-19 pandemic, revealed noteworthy disparities among different admission groups. As we navigate an evolving educational landscape, our findings suggest that embracing blended teaching and learning can enhance students' chances of success. In essence, a thoughtful integration of traditional and online methods becomes imperative for optimising educational opportunities and addressing the complexities of contemporary learning environments.

Keywords. Academic performance, pharmacy students, online learning, COVID-19, admission categories.

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The global landscape of higher education has been substantially reshaped by the far-reaching effects of the COVID-19 pandemic, compelling institutions to swiftly adapt their operational paradigms, instructional methodologies and assessment strategies.[1-3] In response, institutions, including the Faculty of Health Sciences at the University of the Witwatersrand, have undergone rapid transformations by integrating online teaching platforms and digital infrastructure.[2]

However, this transition to online learning has not been without its formidable challenges. Students' unequal access to technology, the limited availability of reliable internet connectivity, and the imperative for faculty to receive comprehensive training in delivering effective online instruction emerged as significant impediments.[3,4] The Faculty of Health Sciences at the University of the Witwatersrand made significant adjustments to its educational approach during the 2020 academic year in response to challenges posed by the COVID-19 restrictions. These adaptations included transitioning to online education, revising the admission policy for the 2021 cohort, and transforming the assessment format from traditional paper-based methods to an online platform. These changes are discussed in the subsequent sections in more detail.

The outbreak of COVID-19 caused major disruptions in higher education institutions, which resulted in changes in teaching methods, examination procedures and admission criteria.[5] The well-adapted strategies to mitigate the spread of COVID-19 affected face-to-face contact and the wearing of personal protective equipment (PPE), among other things. These changes brought unprecedented changes in the institution of higher education.[2] It is crucial to retrospectively investigate the influence of the pandemic and changes made on pharmacy students' learning outcomes.

Amid the COVID-19 pandemic, the Faculty of Health Sciences demonstrated proactive support for pharmacy students and staff by establishing a dedicated committee to facilitate ongoing educational opportunities. Efforts such as encouraging staff to contribute smartphones, offering complimentary data packages, and disseminating

educational materials effectively facilitated students' accessibility to online learning resources, particularly among those residing in remote regions. Furthermore, efforts were made to provide staff members with the necessary skills and knowledge for effective online teaching. Additionally, a strong emphasis was placed on conducting regular assessments, which significantly improved students' readiness for examinations. These initiatives highlight the University's dedication to promoting education in the face of the difficulties posed by the pandemic. The Faculty of Health Sciences displayed proactive support during the COVID-19 pandemic by utilising initiatives such as a dedicated committee and measures to improve online teaching. This resulted in a significant shift to online education, which brought about both challenges and positive outcomes in students' academic performance.

Online education is the method of delivering academic programmes where students and teachers can participate from different locations using computer technologies.[6-8] The Western Behaviour Sciences Institute offered the first online course in 1981, and the invention of the World Wide Web in 1991 enabled a rapid transition to online teaching.[8,9] Online education offers rich and diverse learning resources compared with traditional face-to-face teaching and learning environments.[7] The Faculty of Health Sciences was forced to stop contact teaching and learning and use online teaching platforms to continue with academic programmes in response to COVID-19 social distance restrictions. This mode of education was not commonly used before the COVID-19 outbreak, especially in traditional contact universities. As a result, the pros and cons associated with online teaching platforms have not been the subject of research, especially in the absence of traditional teaching. A study of medical students in the Philippines found that students struggled to adjust to the learning style, home studying, and the lack of communication with educators and their peers.[10] Another study of health sciences students revealed that the students were not happy with the course design; however, prompt responses to the students' inquiries, faculty commitment and preparation for online teaching and maintaining contact with students during lockdown were desired interventions.[10] One of the benefits of online teaching is that it has been navigated and adapted and has yielded positive outcomes in students' academic performance since its implementation.[7,11,12]

Despite the multiplicity of benefits offered by online teaching and learning technologies, the assessment of students through online examination proved to be another difficult terrain for educators.[7] In response to COVID-19 restrictions, most learning institutions worldwide developed and adapted online examination strategies ubiquitously, despite the novelty and other challenges.[12] The primary concerns with online teaching and assessment are the internet (delays in loading or unavailability of the exam questions) and the skills to use technologies for examination.[7] A study exploring perceptions of online teaching and learning among health sciences students found that they were satisfied with the technical support offered during exams.[11] In the South African context, the impact of ongoing load shedding on online teaching and examination has not been explored, and it could be a serious hindrance in the delivery of academic programmes. The major concern was the issue of students cheating in the absence of invigilators. Also, there was a correlation between the time of examinations and an increase in Google searches of words relating to exam topics.[13] Despite the ongoing difficulties associated with online examinations, the worldwide reaction to COVID-19 has forced higher education institutions to quickly reassess their admission requirements and teaching techniques. This has involved moving away from traditional assessment and adopting online learning methods in order to prioritise safety and ensure uninterrupted education.

The COVID-19 pandemic led to a swift need for higher education institutions to adjust their admission criteria and teaching methods promptly. Due to the constraints brought about by the global health crisis, institutions have made the decision to refrain from carrying out traditional assessments that rely on paper-based methods. Consequently, the national benchmark tests (NBTs) were excluded from the student selection procedure for the academic year 2021. However, it was observed that admission decisions were exclusively reliant on National Senior Certificate (NSC) results, despite the presence of evidence indicating its inadequacy as a predictor of academic achievement. In response to the need for safety and continuity in academic programmes, institutions quickly embraced online learning methods, effectively replacing traditional face-to-face classes.[14,15] This allowed them to prioritise the well-being of students and faculty members while still delivering educational content. As the lockdown restrictions gradually eased in 2021, students were allowed back to campus, and teaching and learning adopted a blended approach.

The Faculty of Health Sciences at the University of the Witwatersrand, recognised for its commitment to excellence, employs an admission process reliant on NBT results and the NSC across various domains.[16] The NBT results encompass Mathematics and Academic and Quantitative Literacy, and the NSC subjects include Mathematics, English, and Physical and Life Sciences. The synthesis of these results culminates in a composite index, instrumental in categorising students into distinct admission criteria.[16] Notably, the first category reserves 40% of positions for the highest academic achievers, while the remaining 60% is distributed equitably among top-performing rural students, those from quintiles 1&2 backgrounds, and black and coloured (BC) ethnicity.[16] In South Africa, schools are classified into quintiles ranging from 1 to 5. Quintile 1 represents schools with the lowest socioeconomic status, while Quintile 5 represents schools with the highest affluence.[17,18] The quintile classification is used to indicate a school's poverty score, which is determined by factors such as the unemployment rate and literacy rate.[17]

The composite index (CI), which serves as a ranking system for the four entry categories, was modified between 2019 and 2020 by the Faculty Advisory Committee on Admissions Policy. In 2019, the CI in the top 40 category was set at 72% and was increased to 78% and 81% in 2020 and 2021, respectively. There was a one percent increase from 66% to 67% for top rural and quintile one and two schools between 2019 and 2020. The CI for top black and coloured entry categories was the same between 2019 and 2020. The CIs were increased to 80% in the other three categories in 2021 to compensate for the lack of NBT results owing to COVID-19 restrictions. The first-year subjects for Pharmacy comprise Chemistry, Physics, Introduction to Medical Sciences, Pharmaceutical Practice, and Health Systems Practice. These subjects are taught face-to-face. On a global scale, the Association of American Medical Colleges (AAMC) had to shorten the duration of the Medical College Admission Test (MCAT) used to assess students for the medical programme to reduce the time that students spend in contact while taking the test.[6-8]

These strategic adjustments, however, ushered in unprecedented transformations in the landscape of higher education, further necessitating a closer examination of their implications for academic practices. For example, a standard paper-based assessment format for NBTs was not

feasible.[19] As a result, the Faculty of Health Sciences did not require incoming 2021 students to write NBT tests for selection. Several studies have demonstrated that the NBT is a better predictor for passing the first year of study than the NSC.[16,20,21] This meant that only the NSC results were used to select the students, despite evidence to show its poor predictive capacity for academic performance.[19]

The present study aims to examine the influence of the COVID-19 pandemic on the academic performance of pharmacy students. The objective is to examine the modifications in teaching methods, shifts in assessment and changes in admission criteria implemented by the Faculty of Health Sciences in response to the extraordinary challenges presented by the pandemic.

Objective

The purpose of this study was to understand variations in the academic performance of Pharmacy students from three different cohorts, based on the admission policies used for student selection while taking into cognisance the use of novel online teaching technologies in response to COVID-19 restrictions. The cohorts being examined include the 2019 cohort, who were not impacted by COVID-19, the 2020 cohort, who faced pandemic restrictions, and the 2021 cohort, who completed high school during COVID-19 disruptions and were exempted from writing the NBT for admission to university.

Methods

This study was framed within a quantitative approach. Ethical clearance was granted by the Human Research Ethics Committee (MEDICAL): M220561. Data for students registered between 2019 and 2021 were obtained from Business Intelligence Services for research purposes. The research employed a retrospective quantitative approach to select a cohort of first-time Pharmacy students who were enrolled in the years 2019 - 2021. This study utilised a purposive sampling method to intentionally choose first-time Pharmacy students from three different cohorts. The criteria for inclusion in the study encompassed students who possessed complete data sets, thereby guaranteeing a comprehensive representation. To ensure integrity of the data, a total of 74 students who had cancelled their studies during the first year were removed from the analysis. Moreover, to enhance the data's homogeneity and validity, outliers were identified and subsequently excluded from the sample. Selection of the particular sample utilised in this study, was carefully devised to guarantee a concentrated and dependable examination of the use of online teaching platforms during COVID-19 on the academic outcomes of students pursuing a degree in Pharmacy. The One-Way-Between-Groups ANOVA was used to analyse the data. The One-Way Between-Groups ANOVA was chosen for this study because it allowed us to compare the means of three or more independent groups simultaneously.[22] This analysis is suitable when we have categorical data with one independent variable and a continuous outcome variable. Additionally, the ANOVA test provides valuable insights into whether there are statistically significant differences among groups, aiding in the investigation of potential relationships and variations between compared groups.[23] Data were assessed for normality using histograms, and homogeneity using Levene's test. However, the assumption of homogeneity was not violated, which ensures the validity of the One-Way Between Groups ANOVA analysis.[23] Firstly, the three cohorts were analysed individually using admission categories as a grouping variable, and the first-year progression outcome was the dependent variable. Secondly, the three cohorts were analysed as a grouping variable, while the first-year progression outcome was the dependent variable. The students' first-year progression outcome was continuous, and admission categories and cohorts were categorical variables. The Gabriel procedure was used to compensate for unequal group sizes.[23] Only one student was admitted to the top performing quintiles 1&2 category. Post hoc analysis could not be computed, and subsequently the students was moved to the top BC category.

Results

The sample represents three cohorts: 2019, 2020 and 2021, which account for 37%, 27%, and 37% of the sample, respectively. The largest group comprises Top 40 students, accounting for 44% of the total. Following them are Top Q1&2 students, making up 7% of the total. Top rural students represent 21% of the admissions, while Top BC students account for 28%. The sample consists mainly of black students, making up 61% of the total. Indian students make up 32%, while coloured students make up 4%. White students account for 2% of the sample, and Chinese students have the smallest representation at 1%. The distribution of genders among the students is as follows: 65% female, and 35% male. For a comprehensive description of the sample, refer to Table 1.

The findings from 2019 suggest a plausible variance in first-year academic achievement associated with admission categories, yet the cumulative impact remains modest, as evidenced by the marginal effect $F(2, 101)=2.697$, $p=0.072$. The descriptive statistics showed that the first-year mean scores for Top 40, Rural and BC were ($M=62.78$; SD=7.38), ($M=58.06$; SD=6.71), and ($M= 60.66$; SD=7.87), respectively. Post hoc tests revealed a barely detectable distinction between the Top 40 and Rural groups. However, it is important to note that the difference in effect size between the groups is relatively small, 5.1% of the variance in YOS1 scores. See Fig. 1, showing student mean scores by admission categories.

Table 1. Sample description

Category	Variable	*N* (%)
Cohort	2019	131 (37%)
	2020	96 (27%)
	2021	131 (37%)
Admission category	Top 40	156 (44%)
	Rural	75 (21%)
	Q1&2	26 (7%)
	BC	101 (28%)
Race	Black	219 (61%)
	Chinese	1 (1%)
	Coloured	16 (4%)
	Indian	114 (32%)
	White	8 (2%)
Gender	Male	127 (35%)
	Female	231 (65%)
Place of origin	Rural	96 (27%)
	Urban	252 (70%)
	Unknown	10 (3%)
Progression outcome	Passed	249 (70%)
	Cancelled	73 (20%)
	Failed	36 (10%)

BC = black and coloured.

The 2020 results yielded a statistically significant results $F(3, 73)=13.627$, $p<0.001$, suggesting that there are variations among the groups. The descriptive statistics show that the first-year mean scores for the Top 40 was ($M=76.14$; SD=9.14), Rural ($M=65.60$; SD=4.07), Q1&2 ($M=68.00$, SD=86), and for BC ($M=64.26$, SD=7.13). The post hoc analysis reveals statistically significant differences between the Top 40 group and both the Rural and BC groups. The mean differences are 10.54 and 11.88, respectively. The differences observed suggest that students in the Top 40 category had significantly higher academic mean scores in comparison with the other two groups. Furthermore, the Top 40 group exhibited a substantial mean difference of 8.14 when compared with the Q1&2 group, thus emphasising the notable distinctiveness of the Top 40 category. On the other hand, there were no notable differences observed between the Rural and Q1&2 groups, as well as between the Rural and BC groups. In addition, there was no statistically significant difference in YOS1 scores between the Q1&2 and BC groups (Fig. 2), illustrating the differences in performance based on the admission categories for the 2020 cohort.

In 2021, no differences were observed in all admission categories, and the ANOVA results were statistically insignificant, $F(3, 95)=0.490$, $p=0.690$. The descriptive statistics show that the first-year mean scores for the Top 40 were ($M=68.89$; SD=8.33), top rural ($M=67.47$; SD=4.81), top Q1&2 ($M=67.50$; SD=6.87) and top BC ($M=66.68$; SD=7.08). The effect size analysis revealed that the administrative categories had minimal impact on the first-year academic performance, accounting for only 1.5% of the variance. Post hoc Gabriel tests were conducted to investigate the pairwise differences among the administrative categories. The analysis did not uncover any noteworthy differences between groups (Fig. 3), illustrating the differences in performance based on the admission categories for the 2021 cohort.

The results of the ANOVA showed variations in performance by cohorts $F(2, 277)=28.282$, $p<0.001$. Approximately 17% of the total variance can be attributed to the variability between cohorts. The descriptive statistics showed that 2019 figures were $M=61.23$, SD=7.59; 2020 were $M=69.18$; SD=9.01); and 2021 were $M=68.00$, SD=7.28. A pairwise comparison of performance scores between 2019 and 2020 was statistically significant with a mean difference of -7.95, $p<0.001$. In 2020, students achieved higher mean performance scores compared with those in 2019. The post hoc analysis comparing the 2021 and 2019 cohorts showed a statistically significant result (mean difference=6.77, $p<0.001$). Despite disruptions caused by COVID-19, the academic performance scores of the cohorts in 2020 and 2021 were higher compared with their counterparts in 2019.

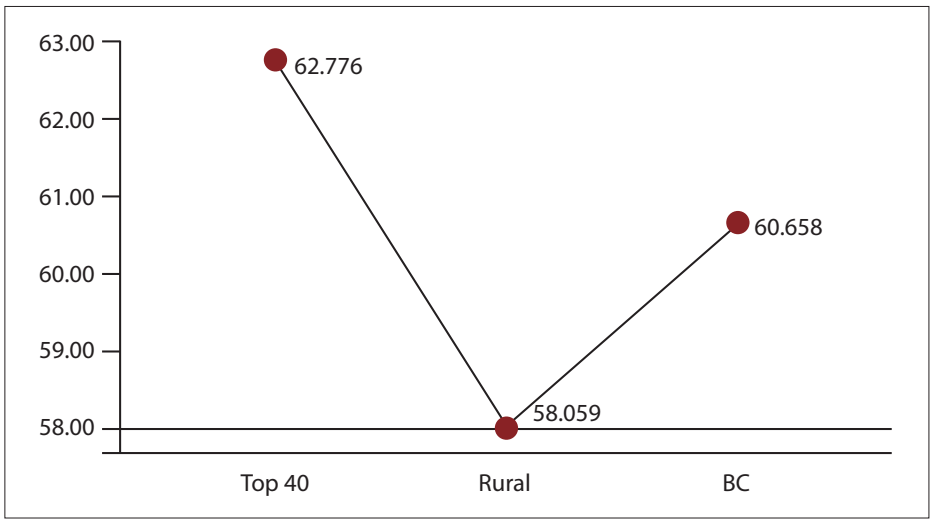

Fig. 1. 2019 first-year mean score by admission categories (N=103).

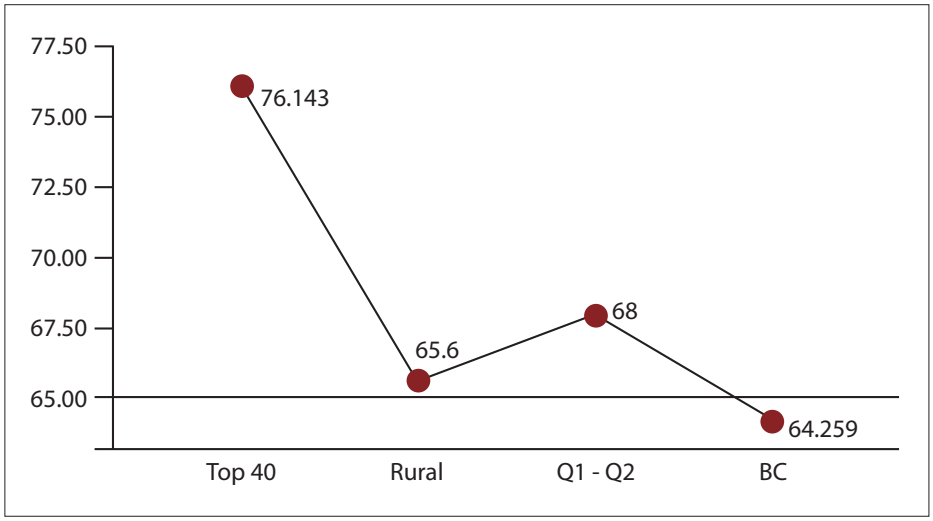

Fig. 2. 2020 first-year mean score by admission categories (N=77).

Discussion

The results of this study emphasise the remarkable accomplishments of the 2020 cohort, which outperformed both the 2019 and 2021 cohorts, despite the significant challenges presented by the COVID-19 pandemic. It is worth noting that students in the Top 40 categories of the 2020 cohort consistently demonstrated higher academic achievements when compared with their peers in both the 2019 and 2021 cohorts. Furthermore, the 2021 cohort exhibited impressive academic performance despite being admitted without undergoing the conventional NBT selection tests. The resilience and adaptability of students during a period characterised by unprecedented disruptions to learning are highlighted by these outcomes.

The initial 21-day lockdown, extended due to increasing infection rates, required academic institutions and the Department of Higher Education to make complex adjustments. The main focus was ensuring the continuity of the 2020 academic year. [5,24] Institutions, faculty and students encountered significant vulnerabilities during lockdown measures and the subsequent return to educational programmes. The challenges included limited access and unfamiliarity with essential technological tools such as laptops and smartphones. Additionally, there were issues

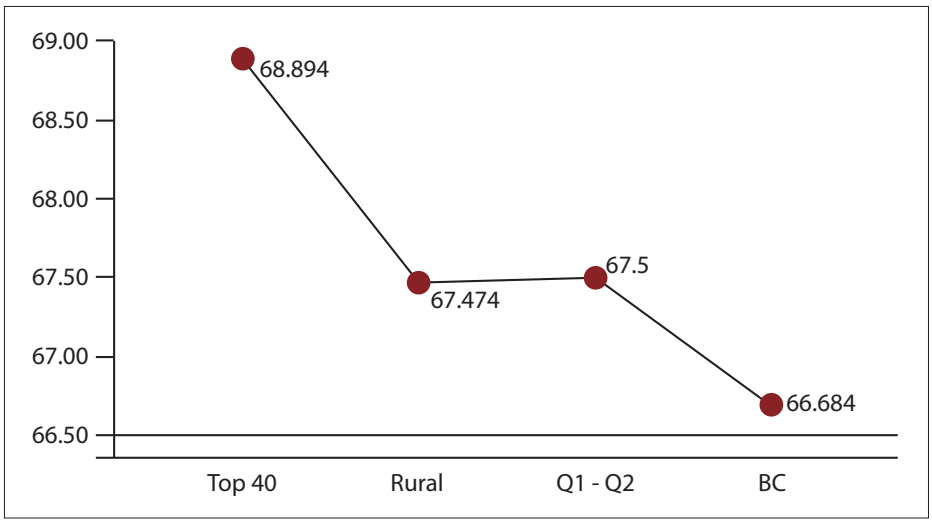

Fig. 3. 2021 first-year mean score by admission categories (N=98).

with unreliable internet connectivity, unexpected disconnections, and economic hardships.[7,14,24] Despite these challenges, the study's findings demonstrate that the 2020 and 2021 groups showed improved academic performance compared with the 2019 group, which suggests that they successfully adjusted to the new online teaching methods introduced during the pandemic.

Lockdowns caused by the pandemic have had significant social, economic and educational consequences; these have raised global concerns about potential learning crises, as highlighted by the United Nations Educational Scientific and Cultural Organisation.[25] The first-year experience is often characterised by various challenges, including adjusting to a new lifestyle, forming new social connections, and managing academic pressures. However, the pandemic may have further intensified these challenges.[26] According to a study conducted on university students' anxiety levels, a notable percentage of 35% reported experiencing moderate to extreme anxiety during the pandemic.[27] The impressive academic accomplishments of the 2020 and 2021 cohorts indicate their ability to handle disruptions effectively. However, it is essential to recognise that they may have also faced challenging experiences.[15,28]

The higher education institutions' widespread adoption of online examinations during the pandemic was an expected response to the prevailing circumstances.[7,12,13,29] There are ongoing discussions about the difficulty of online assessments, but the results of the present study show that students in the 2020 and 2021 cohorts were able to successfully handle the challenges of online exams during the peak of the pandemic. These findings align with similar accomplishments seen among Pharmacy students in Saudi Arabia[29] and medical students who performed well in multiple choice questions (MCQs) and essay exams through online platforms.[30] Furthermore, a study conducted on pathology students found that those who took online examinations achieved higher average scores, even when faced with increased levels of difficulty.[31]

The students' impressive performance in this study during online examinations can be partially attributed to the perceived ease, reduced pressure, and increased flexibility that come with the online examination format.[32] This explanation could account for the impressive academic achievements of the cohorts in 2020 and 2021. Furthermore, a comprehensive examination of performance in different admission categories indicated that students in the top 40 categories consistently achieved higher results than their counterparts in the top rural, BC and Q1&2 categories of the 2020 and 2021 cohorts. These top 40 students even outperformed the top 40 students from the 2019 cohort, which was not affected by the COVID-19 disruptions. The findings indicate that online learning has improved learning outcomes and increased access to educational resources, promoted student interaction, and provided anonymity.[31,33,34] The results also suggest that educators and students have quickly adjusted to online teaching platforms while also recognising the inherent advantages of this teaching method.

In conclusion, the outcomes of this study highlight the remarkable academic achievements of the cohorts of 2020 and 2021 despite disruptions caused by the pandemic. These findings emphasise the importance of using online teaching methods, as they can be utilised in times of crisis and improve learning outcomes. The study emphasises the benefits of online learning and the ongoing importance of standardised admission tests such as the NBT. These tests are valuable for selecting students and assessing their entry-level skills and developing effective support strategies in higher education institutions.[21]

Conclusion

The present research aimed to examine how the COVID-19 pandemic affected the academic performance of different groups of first-year Pharmacy students. The results highlighted significant performance variances, underscoring the need for a nuanced approach to education. The transition to online learning, especially amid the challenges of the COVID-19 pandemic, revealed noteworthy disparities among different admission groups. As we navigate an evolving educational landscape, our findings suggest that embracing blended teaching and learning can enhance students' chances of success. In essence, a thoughtful integration of traditional and online methods becomes imperative for optimising educational opportunities and addressing the complexities of contemporary learning environments.

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