CAPSLEAD



INTRODUCTION

In March of 2020, President Trump declared a national emergency concerning the Coronavirus Pandemi human transmission of the Coronavirus Disease 2019 (COVID-19), quarantine was implemented shifting for school to virtual education. In addition to pharmacy school courses, intern pharmacists learn a multit including compounding, vaccinating, CPR training, and patient counseling. Furthermore, students gain h pharmacy through completing experimental hours from Introductory Pharmacy Practice Experiences (IP Practice Experiences (APPE). All of these experiences are difficult to fully replicate virtually and currently shows the real impact of virtual education. This raises concerns as to whether the virtual pharmacy curi of in-person education.

OBJECTIVE

To evaluate whether virtual education should remain a viable option for pharmacy schools in California by surveying the students from the classes of 2023, 2024, and 2025.

OUTCOMES

Primary Endpoint: Current grade point average (GPA); Learning Secondary Endpoint: Extracurricular involvement and leadership; Wellness (level of stress); Student engagement in classroom activities

METHODOLOGY

To assess whether or not virtual education is a viable option, an anonymous, web-based survey using Google Forms was created and distributed via email to California pharmacy students from the classes of 2023, 2024, and 2025. Prior to completing the survey, participants were instructed to review the Informed Consent Form, which collected data on various aspects of virtual education such as GPA, extracurricular involvements, career preparation, educational finances, engagement, technology, and student wellness. All collected data was stored in HIPAA compliant Google Drive accessible only by study investigators.

The study was conducted between September and December 2022, with 49 participants. The survey consisted of 54 questions including open-ended, close-ended, Likert scale, and multiple choice style questions.

Using the IBM SPSS Statistics/IBM SPSS Statistics Processor version 28.0.0.0, a Kruskal-Wallis ANOVA test was used to compare the median scores of students in three different learning modes: virtual, hybrid, and in-person learning. Numerical values were then translated into graphs and tables using Microsoft Excel. Only participants who had completed a full academic year in a California pharmacy school were eligible for the survey.

STATISTICAL ANALYSIS

A total of 49 people from five different pharmacy schools took part in the study. The Kruskal-Wallis 3+ samples independent test was chosen to analyze the GPA data between in-person, hybrid, and virtual learning assuming since the ordinal data had no confounders and followed a parallel design. The data was analyzed using IBM SPSS Statistics/IBM SPSS Statistics Processor version 28.0.0.0. The alpha significance level was set to 0.05 with a confidence level of 95%. The null hypothesis was that the distribution of the GPAs are the same across all learning deliveries. Since the three independent samples needed at least five observations in each group, the test could not be used to analyze GPAs in semesters four, five, and six, as not all groups had at least five observations.

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Addressing the Viability of Pharmacy Education: Virtual vs. In-Person

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RESULTS

nic in the United States. To limit
g society from being in-person
titude of practical clinical skills
hands-on experience in a
PPE) and Advanced Pharmacy
ly there is limited evidence that
riculum can meet the standards

	P-value Significance Level = 0.05	Ν	Decision Null hypothesis: Distribution of GPAs are the <i>same</i> across all learning deliveries.	
Semester 1	0.535	44	Retain null hypothesis	
Semester 2	0.216	44	Retain null hypothesis	
Semester 3	0.228	42	Retain null hypothesis	
Semester 4**	0.589	24	Retain null hypothesis	
Semester 5**	0.263	17	Retain null hypothesis	
Semester 6**	0.664	17	Retain null hypothesis	

*Multiple comparisons are not performed because the overall test does not show significant differences across samples. **Data from semesters 4,5, and 6 cannot be used since the samples did not meet the minimum requirement of five observations per group to use the Kruskal Wallis test.









Leadership (Figure 3)

49 responses were collected from the anonymous web-based survey. 75.5% of respondents were from University of the Pacific Thomas J. Long School of Pharmacy, 10.1% from Touro University California College of Pharmacy, 6.1% from University of California San Diego Skaggs School of Pharmacy, 4.1% from Loma Linda University School of Pharmacy, and 4.1% from University of California Irvine School of Pharmacy and Pharmaceutical Sciences. Among the respondents, 59.2% were from second-year pharmacy students, 32.7% were from third-year pharmacy students, and 8.2% were from fourth-year pharmacy students. Current first-year pharmacy students of the 2022-2023 school year were excluded from the study as they did not meet inclusion criteria of completing at least one full academic year from a pharmacy school in California.



Wellness (Figure 2)



This study examined and compared the GPA, learning, leadership engagement, and wellness of California pharmacy students across in-person, virtual, and hybrid education settings.

The GPA of a student captures their ability to apply the material that they've been taught during in-class assignments and exams. As this was the primary endpoint of the study, current GPA's of each student were examined based on their in-person or virtual education platform. Since the p-value is greater than 0.05, the null hypothesis was retained that there is no statistically significant difference in the median GPA values between in-person, virtual, and hybrid learning in the first three semesters. However, statistical analysis was not performed for semesters four, give, and six due to a loss of power caused by exclusions such as those who did not complete later semesters at the time of the survey due to time away from school or retaking certain courses. These responses may not accurately reflect their virtual or in-person education. While GPA is an important factor in determining a student's ability to perform during exams, the ability to understand the concepts is not always captured through GPA. According to Figure 1, participants' confidence in understanding and applying course content was spread evenly for virtual education, while for in-person education, the majority strongly agreed.

Wellness is an important aspect in deciding which educational platform is more appropriate for a pharmacy curriculum, this study also investigated students' stress levels, which were generally higher for in-person education. Leadership development and extracurricular involvement were also examined. Developing these leadership skills is crucial for pharmacists to take on future responsibilities, such as taking on managerial or mentoring roles. The study found that a majority of participants felt that virtual education hindered their ability to develop leadership skills, while in-person education did not. Student participation and engagement were explored and found that a majority of participants believed that in-person education increased their attention span. Participation during pharmacy school is particularly important during skills classes as it is important for students to engage in group and hands-on activities.

For limitations, the study had sample size of only 49 participants, which is not generalizable to other populations. Additional confounding variables such as varying levels of access to technology or support from tutors or parents were not accounted for in the study despite potentially influencing student performance and subsequent responses. As the semesters progressed, attrition occurred due to lack of response, N/A response (i.e from retaking a semester and receiving a higher GPA), or other reasons leading to lack of data. A 54-question survey may contribute recall bias and question fatigue, which may alter response accuracy.

The results of this study provide support for virtual curriculum delivery as a possible effective learning modality but may not be effective as in-person instruction. Further research is needed to understand the viability and effectiveness of different learning modalities, including how professors communicate with students, how students learn, and the adaptability of course content.

This survey of pharmacy students in California found no significant difference in GPA between in-person and virtual education. In-person education showed higher engagement, leadership involvement, and learning, but also resulted in higher stress levels. Virtual education was found to be advantageous in various aspects such as better time flexibility, accessibility, and self-directed learning, but lacked face-to-face interaction and was prone to technical issues. The results of this analysis have practical implications that can be used by educators to create a flexible curriculum that combines in-person, hybrid, and virtual courses based on the outcomes of students and flexibility on the subject matter. Pharmacy schools having in-person courses help replicate the interactive workflow and interprofessional communication in a pharmacy setting. However, they can also take advantage of technologies such as simulations by having some courses be held virtually to increase accessibility and build technological skills in students. Further investigation can be done to examine outcomes from specific course subjects held over different platforms and to expand the target population to pharmacy schools outside of California to help guide decisions around curriculum development, resource allocation, and general education policies.

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DISCUSSION

CONCLUSION

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