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Logo

- **Editorial: Artificial Intelligence and Glaucoma**
- **Asynchronous Learning and Cognitive Performance**
- **Posterior Subcapsular Opacification After Cataract Surgery**
- **Pediatric Ocular Trauma**
- **Combination Drugs Efficacy in Primary Open Angle Glaucoma**
- **Retinopathy of Prematurity**

Al-Shifa Journal of Ophthalmology

The Impact of Asynchronous Learning on Cognitive Performance in the Delivery of Undergraduate Ophthalmology Curriculum

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Abstract:

Objective: To determine the impact of asynchronous learning on student performance in the delivery of undergraduate ophthalmology curriculum.

Methods: Randomized controlled crossover study was conducted in the Department of Ophthalmology, Islamabad Medical & Dental College between January 2020 to November 2021. A total of 110 4th year medical students of the Islamabad Medical and Dental College (class of 2021) rotating in the ophthalmology clerkship were recruited in the study. Curricular content in the ophthalmology clerkship is organized into 5 themes, each one representing a specific pattern of patient presentation. Each of the 10 clerkship groups rotating in the ophthalmology department were instructed asynchronously (on line for 2 weeks after which they rotated in the clinic for face-to-face sessions for another 2 weeks.) At the end of each 2-week rotation, the students' performance was assessed via a 70 MCQ paper and their performance in each of the components of asynchronous learning was compared.

Results: A total of 110 (40 male and 70 female) students were recruited in the study. The mean students' score for the themes delivered on line was 34.5 ($\pm$14.7) versus 41.96 ($\pm$16.5) for those taught via face-to-face sessions. This result is statistically significant (P =0.000, t= 5.079, d=109). Students who did well on line, also scored better in the themes delivered face to face. (Pearson's correlation 0.55, p=0.000). Comparing genders, female students did better in the assessment for the themes taught on campus (42.95 $\pm$14.18 vs 39.46 $\pm$15.70) while male students did better in the assessment of themes taught on-line. (38.11 $\pm$15.40 vs 34.90 $\pm$16.70). These results, however, were not statistically significant.

Conclusion: Students tend to do better when taught on-campus, with online learning having a negative impact on their performance. *Al-Shifa Journal of Ophthalmology 2023; 19(1): 8-13. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

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Introduction:

Ophthalmology is a compulsory clinical subject that is taught as a part of the undergraduate curriculum in the medical colleges of Pakistan[1]. The Pakistan Medical & Dental Council has developed a curriculum and a set of competencies that 4th year medical student must acquire during their ophthalmology rotation[2]. How this core curriculum is delivered varies across the country, with most medical schools following the traditional didactic lectures for content delivery, while others utilizing the clerkship model. The clerkship model offers students the opportunity to acquire many core competencies in ophthalmic care, these include patient care, medical knowledge, practice-based

learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice[3]. Live online lectures are a form of synchronous learning as all are present at the same time, so it is interactive. Asynchronous means that they may not be present but learn at their own pace with online resources such as pre-recorded lectures etc, usually not 'live' lectures so interaction is less Asynchronous learning is a means of curricular delivery that utilises electronic technology that allows a student to access the curricular content outside the traditional classroom. In most cases, it refers to a course delivered on line, via the internet. It is an interactive course that allows the participants to interact with the teacher as well as other participants. Research from the Indian subcontinent indicates that asynchronous learning is well accepted as a medium of instruction by medical students[4-5]. The development of asynchronous learning as a means of delivering curricular content has the potential to transform medical teaching, especially in the context of undergraduate students[6,7]. Not only does it connect students and teachers in an efficient as well as economical manner, it also allows students to learn at their own pace[8,9]. Once an efficient asynchronous learning portal has been developed, it may also reduce the load on the faculty running a busy clinic[10].

Research on the impact of asynchronous learning on student performance in our country is still lacking. To the best of our knowledge, the data is lacking from this part of the world.

The purpose of this study was to determine the impact of asynchronous learning on student performance in the delivery of undergraduate ophthalmology curriculum.

Materials and Methods:

After obtaining approval from the institutional review board, 110 4th year medical students rotating in the ophthalmology clerkship of the Islamabad Medical and Dental College (graduating class of 2021) were recruited in this randomized controlled cross-over study. Those repeating the clerkship or doing an elective rotation were excluded. A full disclosure of the study was made to all the students and a written informed consent obtained from all of them.

In our setup, the ophthalmology clerkship/rotation was organized into 5 themes, each one representing a specific pattern of patient presentation. These themes are included: Gradual Painless Loss of Vision, The Red Eye, Ocular Surface Anomalies, Sudden Painless Loss of Vision, The Deviated Eyes. Each of the 10 clerkship groups rotating in the ophthalmology department were instructed via asynchronous learning for 2 weeks immediately after which they rotated in the eye clinic for another 2 weeks. The first 3 themes were delivered via asynchronous learning and the last 2 via face-to-face sessions in the ophthalmology clinic. A detailed schedule along with learning material in form of presentations, pre-recorded lectures, discussion group for each theme, skill videos and simulated patient recorded interviews were always available to the students either via Online streaming (YouTube) or Cloud stored data. Students who did not have access to reliable internet access or were bandwidth limited were given the option to have the data shipped via a flash drive or if possible, they could personally come to the College to copy the data. Asynchronous learning was monitored by the administration of a short quiz administered at the end of each day with the provision of formative feedback. Student performance during the face-to-face sessions was directly observed by the preceptors. At the end of each 2-week rotation, the students' performance was assessed via a 70 MCQ paper and their performance compared between the 2 teaching methods (40 MCQs for online teaching & 30 MCQs for on-campus teaching).

Student's demographics (number, age & sex) were presented as descriptive statistics. Pearson's Correlation was calculated to

investigate the effect size between the two groups. Paired t test was used to determine any significant difference between the scores of the two teaching methodologies. A p value of <0.05 was taken as significant. Independent sample t-test was applied to see if the difference in scores between genders was statistically significant.

Results:

A total of 110 (40 male and 70 female) students were recruited in this study. Of the 110 students, 36.36% students were males and 63.64% students were females. The mean score of the students for the themes delivered online was 34.5 (±16.53), versus 41.68 (±14.77) for those taught via face-to-face sessions (on-campus).

These test results were statistically significant (P<0.01).

Student who did better in on-campus portion of the test also did better in the online portion of the test (r=0.566; p=0.000).

Score by gender is shown in table 1. Overall female students scored better in the on-campus portion of the test (42.95 ±15.18 versus 39.46 ±15.70 for male students), while male students performed better in the online portion of the test (38.11 ±15.40 versus 32.43 ±16.91 for female students). None of these differences, however, were statistically different (p = 0.235 for on-campus and p = 0.084 for online portions of the test). The results are summarized in table 1.

Table 1: Summary of results of students & their test scores categorized by gender

Statistic	Male Students		Female Students	
Students (N)	40		70	
Students (%)	36.36		63.64	
Mean Test Scores	Online	On-Campus	Online	On-Campus
	38.11 ±15.40	39.46 ±15.70	32.43 ±16.91	42.95 ±15.18

Discussion:

With the advent of easier means of communication owing to advancements in technology over the past few years, many individuals and institutions have begun incorporating the use of the internet to provide learning online[11]. This is something that became a major need due to the unfortunate, recent COVID-19 pandemic that rendered many in-person activities unsafe[12]. Our investigations show that students still performed better when instruction was by face-to-face sessions as opposed to online instruction in an asynchronous format. However, taking the entire scenario into context, it must be emphasized that the shift to online asynchronous format was not a planned change; circumstances forced the change

on faculty, students and the community at large. None of the key players had any prior experience in extensive online teaching or learning; it was more or less a learn as you go experience for all. Studying from home was a new experience for most of the students and without any immediate consequences of their performance hanging over their (student's) heads (in the form of attendance, peer pressure, etc.) the seriousness of education, in the online format, was perhaps not present. Our students enter the undergraduate medical program after completing 12 years of schooling, a comparatively younger age as compared to many other countries of the world where the usual entry is after completing 16 years of education (12 years of school plus 4 years of university education)[13]. This relative immaturity is

likely to have an impact as well[14]. Further the funding for the education is, in all cases, borne by parents, families or guardians and not the student; there is no direct financial repercussion of his performance on the student. This is contrasts with the source of funding in many North American and European schools; where funding in primarily the onus of the student[15].

Planned online learning experiences have generally shown to be at-least as effective as class room teaching (ref 6-10 of A)[16-18]. However, this is not universally true[19]. Course content, learner proficiency, extent of interactions available for online delivery are some of the factors that may impact usefulness of online learning experiences and subsequent performance of students.

One major factor that influences student performance during online course is adaptation to the learning environment. Since the change was abrupt due to circumstances, not all students may have been equally prepared for online teaching. Connectivity, family, and other issues potentially can influence the learner's ability to adapt to online learning. This has been shown to affect student performance[20]. The investigators concluded that this change in teaching strategies may temporarily affect student performance in a negative manner.

Students who performed better on the on-campus portion of the test also did better on the online portion of the test. Notwithstanding the overall scores, good students did well irrespective of the teaching strategy. This is also supported by literature[20]. This, in all likelihood is attributable to the student and not the mode of instruction; good students tend to do well irrespective of the medium of instruction as their drive for learning is generally driven by ambition and not via the mode of instruction.

Studies have taken into account the impact of gender on online courses[21]. Generally speaking, male students tend to demonstrate stronger belief in their competence as compared to female

students[22], however this is not always the case21. With increasing age, women seem to have greater belief in their competence as compared to male students which might be responsible for inconsistency seen when comparing gender performance with online and computer-based courses. In parts of the world female students do better in online tests as compared to male students. Students in United States of America, Jordon, Malaysia, Netherlands and China exhibited no statistically significant difference in scores between male and female students[23]. However, in other countries females did better as compared to males, and the overall result also favoured female students[23]. This is in contrast to our own study where male students out performed female students in the online portion of the test. In both cases there were a majority of female students. The differences could lie in the social setup of our society where females, generally are expected to have a greater input in social activities of the household as compared to males; our medical training is geared towards training doctor brides[24]. Whereas the majority of under graduate medical students are girls, the number of practicing doctors are mostly males[25]. This might be a stereotypical view, but contextualization is essential in interpretation of results[26]. Irrespective it is interesting to find that while female students did better overall, male students performed better in the online portion of the test.

Conclusion:

Students performed better in the portion of the written assessment that was delivered face-to-face. Male students did comparatively better in the portion of the written assessment whose content was delivered online. Over-all female students did better in the written assessment as compared to male students. More research is required to ascertain the utility of asynchronous online teaching in the context of Pakistani medical Colleges.

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