RESEARCH ARTICLE

The First Dive into the Ocean of Non-Face-to-Face Learning

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Abstract

Introduction
Students' self-learning time that takes place outside of the classroom is an unmeasured learning time. In medical education, students' learning in the presence and the absence of a teacher are 'Face-to-Face' (F2F) and 'Non-Face-to-Face' (NF2F) learning, respectively. Traditionally, the content of a topic delivered by a teacher in a one-hour lecture is recognized as F2F learning time. However, its mirror NF2F learning time that is students' self-learning remains unknown. The objective of this study was to reckon the NF2F learning time for pharmacology topics taught by F2F one-hour lecture method.

Methods
In a cross-over study, following convenience sampling, two cohorts of undergraduate medical students (N=200) were randomly divided into two equal subgroups; group I and group II. For data purposes, novice and expert faculty categorized based on their teaching experience taught two pharmacology topics (Aminoglycosides drugs and Estrogen drugs) by lecture method. Respondents gave their perceived NF2F (self-learning) time on a Five-point Likert scale. The association of teaching experience and NF2F learning time of students was observed by applying the chi-square test.

Results
For contents delivered in a one-hour lecture, the NF2F learning time by most students was ≥ 3 hours. There was a significant statistical association between students NF2F learning time and teachers' experience for 'Aminoglycosides drugs' [X^2, 95% CI: 4.985, 2.062 (1.087, 3.193), *p* 0.026]. It was noted that the NF2F learning time had no association with gender (*P*> 0.05).

Conclusion
Mostly, the required NF2F learning time is more than double the time of F2F time. The implication of this study suggests that the estimation of students' NF2F learning time may likely be estimated for other topics of pharmacology in a controlled manner.

Keywords: Experienced faculty, Face-to-Face Teaching, Pharmacology, Self-Learning, Teaching experience, Undergraduate medical students
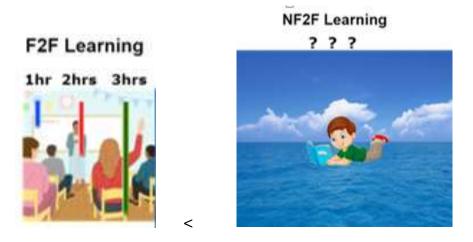
1. Introduction

Pharmacology is an essential course in a medical program. It is important, for medical students, to learn pharmacological principles to apply therapeutical knowledge effectively and safely in clinical practice [1]. In an undergraduate medical program, there is a little practical element in the Pharmacology course, therefore, the lecture-based approach is more appropriate. However, there is great emphasis on acquiring factual knowledge about drugs in this course [2],[3].

1.1. Concept of Face-to-Face (F2F) and Non-Face-to-Face (NF2F) Learning

Student's learning at *Out* of a classroom is termed as Non-Face-to-Face (NF2F) learning [4]. The student's learning happening *in* the classroom *in the presence of a teacher* is Face-to-Face (F2F). Thus, a one-hour lecture that covers the classification of drugs, pharmacodynamics, and the mechanism of a drug is one-hour F2F learning. Likewise, a two-hour practical is, in fact, two hours F2F

time. Nevertheless, how much time students require an act of perceiving for the contents of pharmacology that were delivered in a lecture is still unknown. This learning time '*out of the classroom in the absence of a teacher*' is NF2F time. The NF2F time is associated with the calculation of credit hours. In pedagogy, this domain is yet to be calculated for a diversity of hundreds and hundreds of disciplines at schools, colleges, and universities, therefore, it was given the name 'NF2F Ocean' [4]. This concept is sketched in (Fig.1).

Fig.1: Learning Phases: In the Presence of a Teacher (F2F) Versus in the Absence of a Teacher (NF2F)

Inside classroom learning time (F2F) < **Outside** classroom learning time (NF2F)

Fig.1 shows a conceptual difference between the Face-to-Face (F2F) learning time and the Non-face-to-Face (NF2F) learning time of students. In F2F learning, digits 1,2,3 show the allocated time for various teaching methods. For example, 1 hour is usually for a lecture, 2 hours for practical / bedside teaching / PBL session, and 3 hours for students' lead seminar. Teaching methods have allocated time (known value) but how much students require' time' off the classroom (NF2F) is unknown, therefore NF2F is an ocean.

1.2.   Importance of NF2F Learning

In the calculation of credit hours, both F2F and NF2F learning time take part equally. However, F2F time is measurable while NF2F is still to be estimated. Presently, it is supposed for a one-hour lecture, two hours would be NF2F time. Lectures, practicals, and seminars are F2F teaching methods, all are plotted at a specific time which varies from 1 hour to 3 hours. But evidence based NF2F learning time is still to be explored. Presently, it is assumed 2 hours for most of the topics regardless of the variation and complexity of the topic of a medical discipline.

An academic load of a student is measured in terms of credit hours. A full-time study is equivalent to have 60 European Credit Transfer System (ECTS) credits [5] A bachelor's degree in social sciences is accredited to have 120 credit hours [6] An American certified public accounting degree requires 150 credit hours [7], A medical program with 200-240 credit hours is a harder program compared to social science (120 credit hours) [5,6].

In medical education, the NF2F domain is empty. How much time students would need to grab the contents that are taught in a one-hour time in the classroom, medical

educationists do not have an answer. But certainly, it would differ from course to course and within a course. Firstly, medical subjects vary to a great extent in their level of difficulty. Secondly, even within a subject, a difficulty index is found among topics, for instance, human cell physiology compared to neuroanatomy of the central nervous system. Thirdly, the teaching methods seriously affect NF2F learning. In this pilot study, our objective was to estimate the NF2F learning of undergraduate medical students for one-hour F2F teaching and to compare whether there was varied NF2F learning time if F2F lectures were delivered by experienced and novice lecturers for two different pharmacology topics.

1.3.   Pharmacology Curriculum
Pharmacology is an integral part of all types of medical curricula. In the traditional curriculum, it makes a bulk of course (Pharmacology) that is delivered in the 3rd year of a medical program. However, in hybrid integrated or competency-based curriculums, it is split into many parts and embedded into other modules (systems) which are delivered in year 1 and year 2 of the medical program. For instance, the drugs 'Aminoglycosides' are taught under Antibiotic topics in the traditional curriculum, but they are included in the gastrointestinal tract module in an integrated curriculum. Likewise, Estrogen and Progesterone drugs are part of a reproductive module in an integrated curriculum, but they are enlisted as Endocrine drugs in the traditional curriculum. Many medical colleges, in Pakistan, have adopted the hybrid integrated or competency-based curriculum. However, the chosen medical schools of this study were following the traditional curriculums at the time, when local ethical approval was obtained from institutes, and data were collected.

2. Methods

2.1. Study Settings
This study was conducted in two co-educational independents (private) medical colleges, namely Islam medical college, located in Punjab province, and Baqai medical college located in Sind province of Pakistan. The data were collected from late 2018 to mid-2019.

2.2. Study Design
Convenience sampling – a type of non-probability sampling, was adopted for a cross-over study design.

2.3. Participants
Two cohorts of 3rd-year undergraduate medical students (N=200) as convenience study samples from two medical colleges were chosen. From each college, students (N=100) were randomly divided into two subgroups group I (n=50) and group II (n=50). Faculty members based on their teaching experience were, for *data purpose*, labelled as novice faculty (teaching experience $\leq$ 3 years) and expert faculty (teaching experience $\geq$4 years). The lecturers having experience between 3 and 4 years were excluded.

2.4. Intervention
The didactic lecture is a basic teaching method mostly its duration is of 'one hour' in the traditional or hybrid curriculum. As a pilot study, two pharmacology topics ('Aminoglycosides drugs' and 'Estrogen and progesterone drugs') were chosen from the ongoing teaching schedule.

In a cross-over study, each assigned faculty member from the novice and expert category taught two pharmacology topics (Aminoglycosides drugs and Estrogen drugs) to each group of students in their respective colleges.

To create an impersonal nature of F2F learning, faculty members were not informed

to gauge the learning of students for their delivered topics. Studying from recommended pharmacology textbooks is a medical educational culture and a formative assessment (class test - a common term used) was announced to accelerate self-learning by students.

2.5. Study tool and data collection

A closed-ended questionnaire of a Five-point Likert item was prepared according to the study purpose. The pharmacology topics ('Aminoglycosides drugs' and 'Estrogen and progesterone drugs') were mentioned in the questionnaire that were taught in face-to-face one-hour time, the students' non-face-to-face (i.e., self-learning) time was allocated based on the complexity of the topic. Recalling the personal experience of 1st and 2nd authors as medical students, a range of time from 2 hours to 5 hours was allocated for each pharmacological drug. However, in the questionnaire, one-hour time was also added. The other relevant demographic information was included to explore the data more meaningfully.

Students were informed through a class representative about the data collection. A briefing on study purpose was given, consents were obtained before the questionnaire was distributed which had information about the student self- learning time. Students were informed verbally to estimate the self-learning time they took to understand the chosen pharmacology topics. The range for self-learning time was from one hour to five hours, but they could add if they had taken more time. Students gave their perceived NF2F learning time on a Five-point Likert scale by filling up the questionnaire and handed it to the faculty staff.

2.6. Data analysis

Categorical data of NF2F learning time was expressed in frequency, percentage, and mean and standard deviation were used for numerical data. Data from two colleges were combined based on faculty teaching experience to achieve the effect. The students' NF2F time associated with the teaching experience of faculty was analysed by applying a chi-square test in SPSS, Version 23.0. Type 1 error was set to 0.05, assumptions were checked, 95% CI was set and p-value of less than 0.05 indicated a statistically significant result.

Respondents gave their perceived self-learning (NF2F) time on a Five-point Likert scale. Data were analysed and the association of teaching experience and NF2F learning time of students was observed by applying the chi-square test.

3. Results

A total of 200 questionnaires were distributed to students of the 3rd year of two medical schools and 188 students [Islam Medical College (n1=93), and Baqai Medical College (n2=95)] completed and returned the questionnaire, therefore, the response rate was 94%.

3.1. Mean Score of Non-Face-to-Face (NF2F) Learning Time versus One-hour Face-to-Face (F2F) Teaching

Categorical data were expressed in frequency and percentage. Descriptive analysis showed the NF2F learning time for the two different pharmacology topics varied from 2 hours to 5 hours. For a one-hour F2F lecture, less than 20 % of students reported they needed 2 hours to understand 'Estrogen and progesterone drugs' (Table 1).

A greater number of students spent 3 hours comprehending the contents delivered in one hour for both pharmacology topics (Table 1). There was a considerable high number of students who spent 4 hours also for 'Estrogen and progesterone drugs (26%). A relatively lower number of students took 5 hours to understand the concept delivered in one hour (Table 1).

Table 1. Estimation of Non-Face-to-Face Learning of Undergraduate Medical Students for One-Hour Face-to-Face Teaching (N=188)

NO.	(Face-to-Face) Pharmacology topic (Lecture one hour)	(Non-Face-to-Face) Self-Learning Time N =188				Mean	SD
		2 hours	3 hours	4 hours	5 hours		
1	Aminoglycosides drugs	56 (29.9 %)	76 (40.4 %)	41 (21.8 %)	15 (8.0 %)	3.08	0.913
2	Estrogen and Progesterone drugs	37 (19.7 %)	76 (40.4 %)	49 (26.1 %)	26 (13.8 %)	3.34	0.948

None of the students perceived one hour as NF2F for one-hour F2F teaching. However, NF2F learning time varied from 2 hours to 5 hours. Majority of students required 3 + hours to recognize the contents delivered in a one-hour lecture. In calculation of Student learning time for Estrogen drugs (SLT = F2F+NF2F= 1 +3.34 = 4.34 Hours). This is for one topic, for other topics, NF2F time would be calculated likewise. This is a little evidence for NF2F time, in other words, an initial step towards the calculation of Pharmacology credit hours.

3.2. Students' Non-Face-to-Face Learning Time versus Lecturers' Teaching Experience

Data from both medical schools were combined, there was significant statistical association between students' non-face-to-face (self-learning) time and teachers' experience for both 'Estrogen and progesterone drugs' [X^2, 95% CI: 7.571, 2.885 (1.330,6.259), *p* 0.006] and Aminoglycosides drugs [X^2, 95% CI: 4.985, 2.062 (1.087, 1.087), *p*= 0.026] (Table 2). It was worth noticing that the NF2F recognition between two different pharmacology topics was significantly affected by the teaching experience of faculty members.

Table 2: Comparison of Students' Non-Face-to-Face Learning Time for Experienced and Novice Lecturers

Variable	Students' Learning Time (SLT)			x^2 (*df*)	OR (95% CI)	*P*-value
Teaching experience of Faculty	Face-to-Face Teaching Lecture (One hour)	Non-Face-to-Face Learning (Hours)				
		NF2F $\leq$ **2**	NF2F $\geq$ **3**			
Novice		n (%)	n (%)			
	Aminoglycosides drugs	35 (37.2)	59 (62.8)	4.985 (1)	2.062 (1.087 – 3.193)	0.026
Expert		21 (22.3)	73(77.7)			
Novice	Estrogen and Progesterone drugs	26 (27.7)	68 (72.3)	7.571 (1)	2.885 (1.330 – 6.259)	0.006
Expert		11 (11.7)	83 (88.3)			

Chi-square: teaching experience and NF2F learning time found a significant association (*P*= 0.05)
F2F = Face-to-face (i.e., presence of a teacher); NF2F= Non-face -to-face (i.e., absence of a teacher)

Considering a textbook of Pharmacology, the very first chapter 'General pharmacology' is 80-100 pages, and it is taught in 2-3 lectures, students are expected to read 25-30 pages for a lecture. Reading speed varies subject to subject and studying with understanding would take more time. And each chapter varies in its difficulty and complexity. Aminoglycosides are a different group of drugs from Estrogen and progesterone drugs.

Their mechanism of action, side effects, usage are different from each other.

Another aspect of NF2F learning was contemplated with gender. We found no statistical difference in NF2F learning of students (p >0.05) in terms of gender when a one-hour lecture on 'Aminoglycoside drugs' was delivered to them (Table 3).

Table 3: Gender-based Association of Non-Face-to-Face Learning with Face-to-Face Teaching

Students' Learning Time (SLT)						
Face-to-Face Teaching Lecture (One Hour)	Gender (n)	Non-Face-to-Face Learning (Hours)		x^2 (*df*)	*OR* (95% CI)	*P*-value
		NF2F* $\leq$ **2**	NF2F $\geq$ **3**			
Aminoglycosides drugs	F (114)	n (%)	n (%)	0.445 (1)	0.802 (0.420 – 1.553)	0.505
		36(31.6)	78 (68.4)			
	M (74)	20(27.0)	54(73.0)			
Estrogen and Progesterone drugs	F (114)	26 (22.8)	88 (77.2)	1.791 (1)	0.591 (0.272 – 1.284)	0.181
	M (74)	11 (11.7)	63 (88.3)			

NF2F*= Non-Face-to-Face, Chi-square: Gender has no association for NF2F learning of students. 'Estrogen and   Progesterone drugs' [X^2, 95% CI: 1.791, 0.591 (0.272, 1.284), *p* 0.181].

4. Discussion

The purpose of this study was to estimate NF2F (Unknown time value so far) corresponding to F2F (known time value). From the results of one-hour F2F teaching, surprisingly, none of the students reflected one-hour NF2F time. This not only depicted the complexity of the contents taught but reinstated the main issue of NF2F, which is the time required.] Also, listening and reading are two tasks in the teaching and learning process. It was worth noting that the study participants spent a long time completing the reading comprehension task for the corresponding speech sentence comprehension [8] It complies with our study result.

Studies have shown improved learning in groups [9,10,11] The students who reflected NF2F learning '2 hours', might have adopted collaborative learning. Earlier, there was no evidence on how much students spend time outside the classroom for the corresponding knowledge they received from instructors in the classroom. The results show despite some of the limitations of this study, that students' self-study time would differ from topic to topic within the pharmacology subject. It revealed that students needed more hours to grab the knowledge of clinical pharmacology [12].

A diverse NF2F (self-understanding) ranging from 3 to 5 hours was perceived. The statement "novice students may not assess accurately their learning followed by their experience in a classroom" is not entirely true. The results of a study concluded that the US has the largest pool of adult learners who are aware of their metacognitive skills.[13,14] Moreover, another piece of evidence describes the knowledge measurement of medical students.[15] This was consistent with our study population and their NF2F recognition of learning.

For a one-hour F2F teaching time, students' NF2F learning time was $\geq$3 hours for both 'Aminoglycosides drugs' and 'Estrogen and progesterone drugs. The NF2F learning time was inversely associated with the experience

of faculty members (table 2). The more experienced teacher, the more time the students spent to grab the knowledge delivered in one-hour time. An experienced teacher covered more information in one hour, or he/she has discussed the topic in more depth making it harder for students to understand in a shorter time.

However, this impact could be overlooked in another aspect. Routinely, lecture-style creates an environment where backbenchers might disengage if they wish, from active learning. Presently, the COVID-19 pandemic has imposed atypical changes in educational institutes. There is transitioned to resume teaching-learning activities using live virtual platforms. The non-discriminatory nature of the *Online* learning environment eases disengagement like F2F teaching. A student can falsely present by disconnecting from active learning while turning off the video and audio functions [16].

Teaching impact divaricates from region to region even institute to institute. When the personal characteristics of model teachers were included, their lecture-based teaching methodology harmed the students' perception [17]. A traditional way to measure teachers' teaching style is students' feedback. It is considered a valuable tool to enhance the teaching method of teachers [18,19] Getting feedback is part of the quality department and implemented every semester. Experienced teachers have received a greater number of feedbacks as compared to teachers who have little teaching experience. Better learning of pharmacology was documented through improved teaching method [19] despite lack of assessment, students having 3± hours to

study the contents of a drug was an indication of their improved learning.

4.1 Limitations and further research
A limitation of this study was that we could not verify the students' claimed NF2F learning time with their assessment achievements. We encourage researchers to imply the PBL method and seek NF2F learning time comparing the lecture versus the PBL method.

5. Conclusion
In summary, for the one-hour teaching of pharmacology drugs, the perceived NF2F learning time of students was 3+ hours. None of the students needed a one-hour NF2F learning time for one-hour F2F teaching of pharmacology topics. Rather, NF2F learning time varied from 2 hours to 5 hours. Majority of students required 3+ hours to grasp the contents of pharmacology delivered in a one-hour F2F lecture. Students'NF2F learning time had no association with gender, however, they required more NF2F time when taught by experienced teachers. The perceived NF2F time needs to be verified with assessment because the connections between F2F and NF2F remain to be fully clarified.

Conflict of interest
Authors declare that none has a conflict of interest

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