Study Pattern and Need for Learning Management System for Pharmacy Practice Students of Select Colleges in South India: A Pilot Study

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A B S T R A C T

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Objective: To do a pilot study to understand the study habits of the post-graduation (PG) pharmacy practice students in India and their perspective on the use of a Learning Management System (LMS) in line with the current system of education to meet the industrial requirements in the Indian scenario.

Materials and Method: The researchers administered an open labeled questionnaire to understand students study pattern, expectations from the use of a LMS to support their study goals. Consent was obtained from the students to use the data provided for deriving inferences for research purposes. Data was collected from all the students belonging to two premier private pharmacy colleges in Bangalore, India and converted to graphical representations using Microsoft excel to provide simple percentages.

Results: The current trend in pharmacy education system shows that the PG students study/learn mostly during the internal and external examinations. This is a due to the pressure of doing well in the examination. This study also showed that the students learn mostly from discussions, seminars and examinations. It was observed that the students wanted a proper orientation program that will train them in the best way to complete the PG course and to know of the options that will be available for them once they have completed the course. 82% of the students were excited to have the support of LMS to provide them with a dashboard view of their performance in comparison with the rest of the class. This excitement can be related to the goal of the student to be competitive in the industry to get better opportunities if they can do well in their PG course.

Conclusion: This pilot study should be considered as an eye opener, as it shows that the pharmacy practice PG student's needs continuous support in terms of online lectures, research support, practical training, etc. which is currently unavailable. This support can easily be provided with the use of LMS that will support the students round the clock with guaranteed benefits as shown from studies conducted around the world in pharmacy colleges.

Keywords: Post-graduation, Pharmacy Practice, Learning, Management, Study Pattern.

INTRODUCTION

The International Pharmaceutical Federation (FIP) under the guidance of World Health Organization (WHO) held a conference in Vancouver (1997) for developing guidelines in Good Pharmacy Education Practice. WHO in their report on "Preparing the Future Pharmacist" identified seven roles (the "seven star pharmacist") which should be considered essential, minimum common expectations of pharmacists by health care systems world-wide. The identified roles and responsibilities were: Care giver, Decision maker,

Communicator, Leader, Manager, Life-long learner, Teacher.[1]

The 13 points that are listed by the federation, focuses towards constant evaluation and upgradation of the current system of education provided to the pharmacist all around the world.[1,2] This "focus towards betterment of the current education system" should also reflect in the Indian scenario, by creating a better training, teaching environment for the students such that they will be able to perform better. While all the points listed by FIP can be debated as 'have been implemented' into the current education system, it can be easily seen that they lack the 'depth' which takes away the actual intended purpose. The 'Depth' into implementation can only be obtained if there is sufficient revision based on continuous feedback that is provided by the students, faculty,

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college and university in order to uplift the educational status of the Pharmacy profession of the country. The recommendations on *Good Pharmacy Education Practice* provide only a conceptual framework for the design, implementation and assessment of contemporary educational programmes for pharmacists throughout the world.[1]

Pharmaceutical education in India has progressed very much in the last 50 years. From almost non-existent at the time of independence, it has grown sufficiently enough to generate highly skilled and technical manpower, to generate/create wide spectrum of pharmaceutical activities associated with the drugs/medicines in the country. There are numerous problems, which creates barriers in development of pharmaceutical education. Some of the problems that could have led to the decline of quality and quantity of Indian contribution to pharmaceutical sciences are as follows:[2,3]

- Minimum or no industry-institute interaction.

- Minimum or No computer aided pharmacy education.

- No proper training for teachers.

- Minimum collaboration with foreign pharmacy institutes and distance education.

Study objective: This study derives its soul and energy from "The Pharmacists Oath" specifically, points "(3) I shall strive to perfect and enlarge my knowledge to contribute to the advancement of pharmacy and public health" and "(7) I shall associate with organizations having their objectives for betterment of the profession of pharmacy and make contribution to carry out the work of those organizations". This study was undertaken to understand the post graduate (PG) student expectations when they join the PG course in pharmacy.[4] This study will try to capture the following details:

- Understand the problems that are faced by the student with respect to the study patterns and provide possible solutions

- Understand the student perception about a support system that would be supportive to the students to meet their goals apart from meeting the goals of the college, the university and national goals of the profession

- Understand the gap between the recent industrial requirements and the pharmaceutical education in India

- To find out from students about their needs to be meet the current industry requirements.

Need for study: Shrivastava et al. conducted strength vs. weakness analysis of the scope of pharmacists in the last decade, which clearly indicates the need to strengthen pharmacy education in-order to face the new challenges.

They also found that the pharmacists of today, has to answer a critical question posed by the medical staff, - "How is pharmacist's knowledge complementary in medical sciences to that of the other medical staff to provide better patient healthcare?" For the present pharmacist, this is indeed a difficult question to answer.[2,5]

It is no secret that after a pharmacy student completes his/her education at a masters level, and comes to the industry, they suffer from lack of communication skills, leadership skills, basic management skills, training skills, decision making and above all, stops learning further and supporting self-goals and upliftment of junior pharmacists. In-order to understand the current areas of improvement, it is necessary to understand the students study patterns and expectations from the current pharmaceutical education system. This study attempts to understand the current study habits of Clinical Pharmacy Practice students and the use of a Learning Management system (LMS) to support their study requirements as per the guidelines of the university.

The Answer: To meet these requirements of change, certain modifications have to be made to the current/conventional teaching method. The changes to be brought out are as follows:[2,3]

- From unidirectional teaching (Lectures) to interactive teaching and learning (Discussions)

- From memorization for examinations to emphasis on clarity of concepts for application

- From monotonous lectures to videos or discussions using 3D models

- From a passive listening student to an active participating student

The above listed requirement could be met with the help of an LMS, which is developed keeping the student, college and university requirements and curriculum as the core. The LMS should be developed based on pointers from models of instructional design and adult learning psychology like ADDIE (Analyze, Design, Develop, Implement, and Evaluate), Bloom's Taxonomy, Gagne's Nine Events and ARCS (Attention, Relevance, Confidence & Satisfaction).

MATERIALS AND METHOD

Selection of Study Site: For the study, Al-Ameen College of Pharmacy and Visveswarapura Institute of Pharmaceutical Sciences were identified in Bangalore, Karnataka, who were willing to set up a student support system for academic excellence that would support the educational goals set by the college and university (Rajiv Gandhi University of Health Sciences). The selection was based on the criteria of accomplishment, credibility of the college, facilities provided

by the college and courses offered by the college (M. Pharm [Pharmacy Practice], PharmD and Ph.D in Pharmacy). The study team got the necessary permission and support for conducting a free seminar on "Presentation and Study Skills for Students" from Al-Ameen and Visveswarapura pharmacy departments. After obtaining permission from the principal and faculty members, the date for the seminar was decided. M. Pharm Pharmacy Practice students were notified about the seminar two weeks in advance via notification on the announcement board of the college, as they were the targeted audience.

Selection of Students: The pilot study for understanding the need for a better system of learning was conducted, with the permission and support of the Faculty of the respective colleges. The interested candidates who were in their 1st year or 2nd year M. Pharm [Pharmacy Practice] were encouraged to attend the seminar at the auditorium provided. The objective behind preventing forced attendance was to get a major percentage of the students who would be interested to excel in academics and the pharmacy practice profession. This would result in collection of the most authoritative data from the students.

Development of Questionnaire: A questionnaire was developed with the help of senior Faculty members to understand the following:

- Were the students provided with an orientation program in the department about the course and the professional prospects after the same

- What helped them in understanding the concepts for each of the chapters clearly

- Learning/study habits of the students during the course

- Would a centralized monitoring system be helpful in tracking and planning the study throughout the course and after that for obtaining suitable jobs.

- How can the topics for the pharmacy practice course be made more interesting according to the students

Data Collection: The pilot study was conducted by administering the survey questionnaire that was developed with the help of senior faculty members who had vast experience in teaching and student behaviors. A copy of the questionnaire was distributed to the students after the seminar (Study Skills). The students were given 15 minutes to complete the questionnaire. The students were free to ask for clarification if they did not understand any question. The data was obtained in hardcopy and transferred onto a Microsoft Soft Office–Excel sheet for simple analysis and graphical representations. All the students who participated in the survey, completed the questionnaire and gave their approval to use the inference for research purpose.

RESULTS

From among the total of 52 students who represent M.Pharm [Pharmacy Practice] at Al-Ameen College of Pharmacy and Visveswarapura Institute of Pharmaceutical Sciences, only 38 students participated in the seminar entitled "Presentation and Study Skills for Students". It was observed that the attendence of M.Pharm 1st year students was more in number when compared to the 2nd year students. There were 22 students from 1st year accounting for 58% of the study population and 16 students from 2nd year accounting for 42%.

Fig.1: M. Pharm Pharmacy Practice Student in study
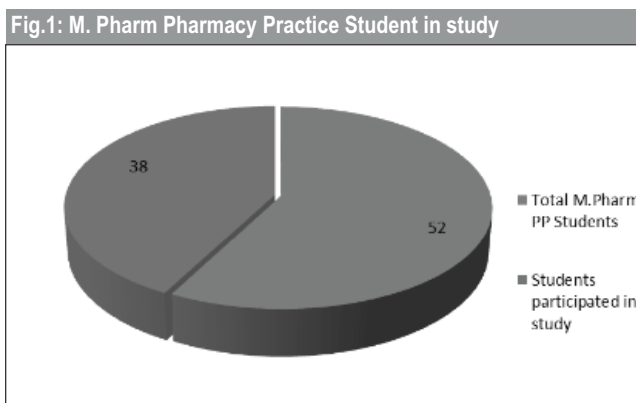
The students were asked if they had an orientation program that would explain the course curriculum and the probable opportunities that they may have in the hospitals or the current related industry. Out of the total of 38 students, 31(82%) said that they did not receive such an orientation while 7 (18%) students said that they got this information from their seniors (See Fig 2). It was observed that the students were attending classes as per the guidelines of the university. The study showed that 17 (45%) students had an attendance between the ranges of 70%-80% while 21 (55%) students were between the attendance ranges of 80%-90%.
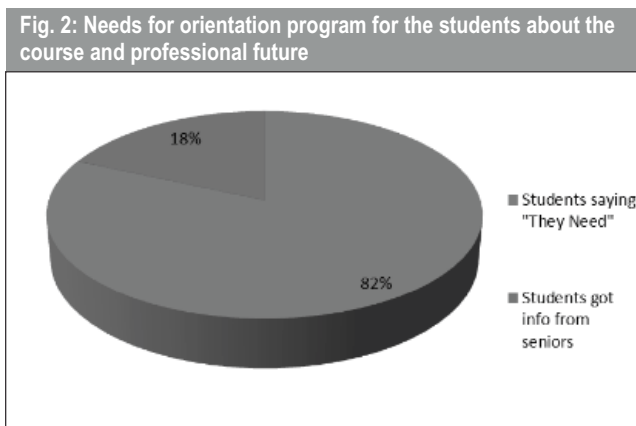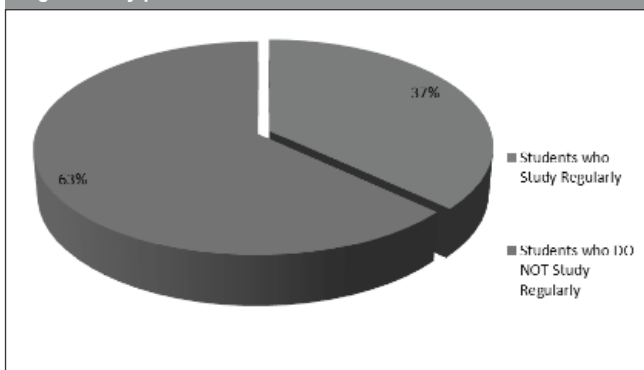

Fig. 2: Needs for orientation program for the students about the course and professional future

Fig. 3: Study pattern for students

The researchers observed from the data collected on the general study patterns of the students that 63% of the students (N=24) does not study regularly. In a "per day study pattern analysis" by the researchers, it was observed that maximum number of students studied for an hour every day (N=21) which accounted for 55% of the study population (Fig 3). It was also observed that 10.5% of the students (N=4) spent 2hrs while 3 students spent 3hrs and 4hrs daily accounting for 8% of the study population respectively. It was also observed that none of the students spent 5hrs or more hours studying regularly per day (See Fig. 4).

Fig. 4: Student study profile per day
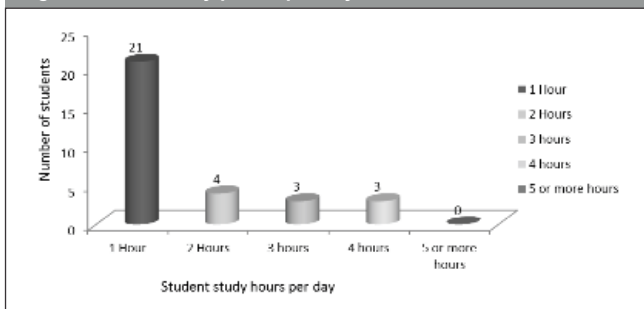
It was observed that just one week prior to the internal examination 47% (N=18) of the students spend more than 5hrs of study per day, while 26% (N=10) spend 4hrs per day, 6 students (16%) spends 3hrs and 4 students said that they spend 2hrs per day. It was also observed that none of the students studies for 1 hour per day during this time period (Fig 5).

The students weekly study pattern during the internal examination revealed that 53% (N=20) of the students study one week before the internal examination while around 24% (N=9) study two weeks before the internals and 16% (N=6) start preparing for the internals from the 3rd week. Only 8% (N=3) of the total population said that they study regularly (Fig 6).

Fig. 5: Student study profile per day (1week before Internal Exam.
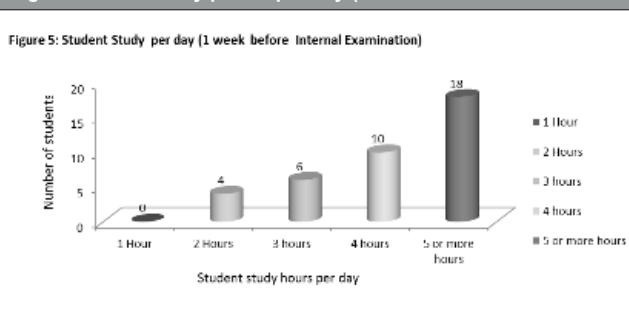
It was noticed that 74% (N=28) of the students spent more than 5hrs daily one week before the final examination when compared to the other internal examination and the regular course. Around 10.5% (N=3) of the students spent more than 3hrs studying during for the final exams, while 8% (N=3) of the students said that they spent 4hrs. 8% of the students said that they studied for one hour just one week away from the final examination (see Fig. 7).

The study also showed that 34% (N=13) of the students studied from discussions. Around 29% (N=11) of the students felt that they study mostly during the internal examination while around 18% (N=7) of the students felt that they studied mostly from seminars and during the final examination respectively (see Fig. 8).

An attempt was made to understand the subjects that the students liked and why, Based on the response from the students, it was understood that 40% (N=15) students who

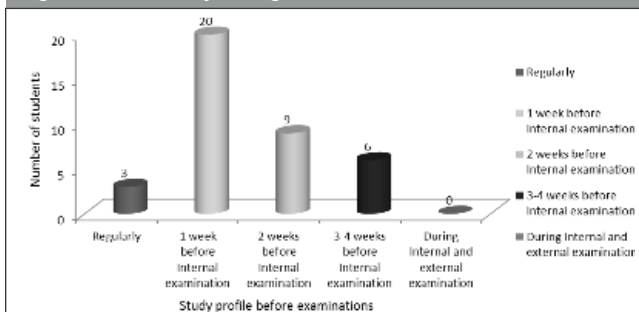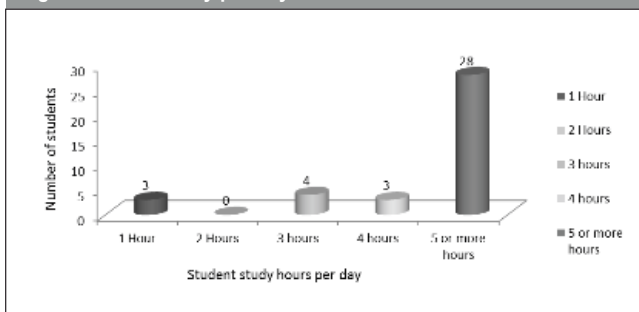**Fig. 6: Student study during Internal Exam**

Fig. 7: Student study per day one week before final Exam

enrolled into PG in Clinical Pharmacy Practice liked Pharmacotherapeutics subject. It was also observed that 34% (N=13) liked Pharmacology while 26% (N=10) liked Pharmaceutics as their favorite subject (see Fig. 9).

An attempt was made to understand the reason for the students having certain subjects as their favourite from the B.Pharm level. The study showed that 71% (N=27) of the students felt that they like the subject as it is interesting irrespective of who is the faculty. Around 29% (N=11) of the students said that they like the subject because the lecturer is good in teaching the subject. However, out of the options provided, none of the students opted for options that said that they were interested in the subject as it can get them a job or because scoring marks in this subject was easy (see Fig. 10).

Also an attempted was made to understand the subjects that were most disliked from a B.Pharm level by the students and

why. It was observed that out of a total of 38 students, 74% (N=28) of the students disliked Chemistry. It was also seen that 10% (N=4) of the students disliked Pharmaceutics and around 8% (N=3) of the students disliked Jurisprudence and Pharmacotherapeutics (see Fig. 11). 55% (N=21) of the students said that they disliked the subject because the faculty did not make the subject/topic interesting while around 37% (N=14) of the students said that they did not understand the subject and hence did not like it. Around 8% (N=3) of the students felt that they could not get any external help as support for the subjects that they found difficult and that there was none other than the faculty to provide them with any support on the subject (see Fig. 12).

34% (N=13) of the students felt that, the subjects and academic topics could be made more interesting if the classes were made interesting with industrial relevance for each topic, assigning of mentors with proper goal setting and access to friendly subject matter experts, 24/7 (see Fig. 13). On the other hand 32% (N=12) of the students mentioned that they would be happy if the classes were made more interesting with proper explanation. Four students (10% of the study population) felt that industial relevence would make the topics interesting. Eight percent of the study population felt that assigning mentors, friendly subject matter experts and round the clock support would make the topics interesting.

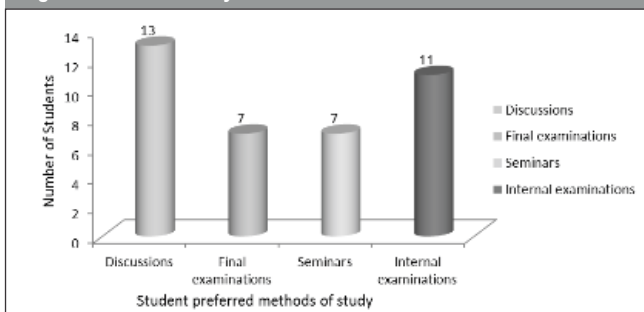Fig. 8: Maximum Study results for students

Fig. 9: Subjects most liked during B.Pharm level by the students in the study
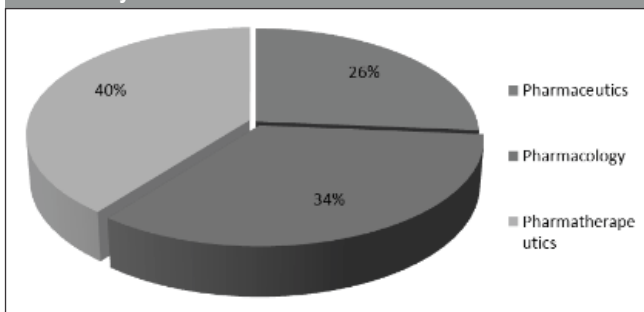

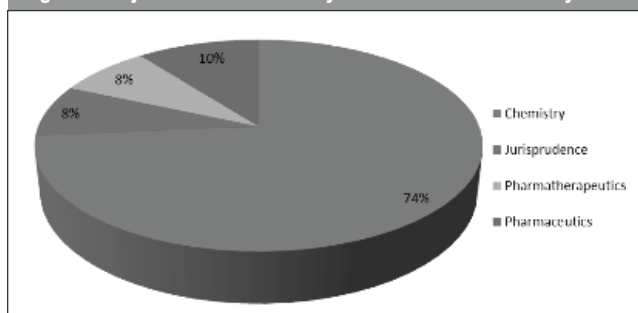Fig. 11: Subjects most disliked by the students in the study

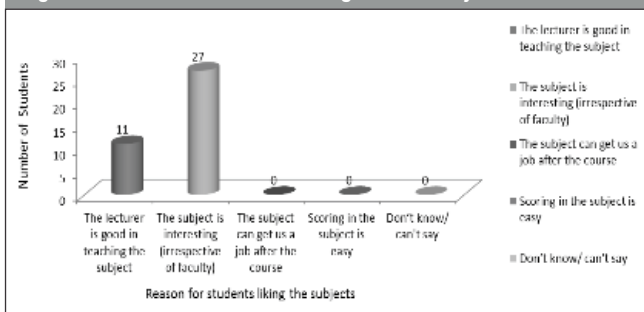Fig. 10: Reasons for students liking selects subjects

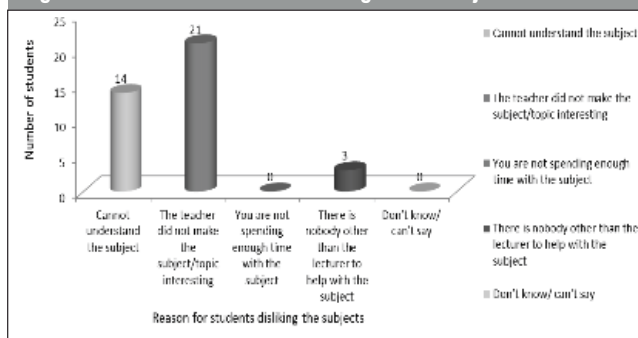Fig. 12: Reason for students disliking select subjects

Fig. 14 shows the responses of the students on the student need of a LMS that will provide an option for "Single window monitoring" of performance during the course. 82% (N=31) of the students wanted LMS which will provide a Single-window monitoring system to support them in terms of their performance. It was also observed that around 18% of the students mentioned that they "May-be" interested in the single window monitoring system.

DISCUSSION

The total number of students enrolled in PG course (Clinical Pharmacy Practice) ranges between 10-12 students. This approval is provided by the Pharmacy Council of India (PCI) or All India Council for Technical Education (AICTE) based on the resources, faculty, space available for ensuring that there is the best possible output of students who can contribute to the betterment of the society and the profession.[2,5]

As per the results depicted in Fig. 1, the participation of 38 out of 52 students (73%) can be because of the upcoming internal examinations for which the students have to prepare. It was also seen that 1st year students (22 students, 58%) were more interested in the study skills seminar that was organised when compared to 2nd year PG students (16 students, 42%). This is because the 1st year students will have to take up the internal and final examinations that are scheduled as per the guidelines of the university, while the 2nd year student will have only a specific examination based on their thesis work.

Fig. 13: students view on methods to make topics interesting

Fig. 14: Students Perception on single window monitoring performance

Pharmacy practice curriculum enters its fifteenth year in India, since its beginning in 1997. A decade long journey of pharmacy practice curriculum in India provides some key insights below which highlights the current issues that are faced by PG's in Pharmacy Practice:[5,6]

1. The position of a clinical or hospital pharmacist is restricted only to the hospitals linked to a pharmacy practice school. This results in prospective postgraduates not having the opportunity to work as a clinical pharmacist. This can be perceived as the lack of understanding about the value addition by clinical pharmacists in the current medical set-up in Indian hospitals.

2. The Indian healthcare regulatory framework does not recognize the need for clinical pharmacists at the national level. As time goes by even if the regulations were framed as , there would be lack of experienced clinical and hospital pharmacists to fill in and add value to the healthcare system due to the mass migration of trained clinical pharmacist to the pharmaceutical industry. Pharmacy council and professional leaders need to discuss with relevant stakeholders to create suitable positions in the hospital set-up where a trained clinical and hospital pharmacists can fit-in to support the profession and contribute to a better healthcare system in the country. In the absence of this initiative, the Indian healthcare system will lose all clinical and hospital pharmacists graduating in M.Pharm (pharmacy practice) and Pharm.D to other countries where the demand of these professionals is high.

3. There is a gap between the number of students graduating from pharmacy practice institutions and the actual number employed as pharmacy practitioners in the hospital setup. This has to be addressed by creating suitable openings for clinical and hospital pharmacy professionals in the hospitals or by making them competent to take up other challenging jobs in the industry that come up due to globalization. It should be noted that there are a number of new job opportunities that have opened due to the globalization and cultural exchange that is currently happening in the country. Some of the new industries that have sprung up during recent times are Clinical Research, Medical Communication, Data Management, Pharmaco-vigilance, Scientific Writing, Contract Manufacturing for Global Multinationals, Pharmaceutical Project Management, Regulatory Affairs, etc.

Such concerns can be addressed to a certain extent by providing the students with suitable orientation programs at the initiation of the course. As observed from Fig. 2, the students have not been oriented towards the expectations from the course that they have undertaken. Orientation program will be narrated to the students as a set of classes to
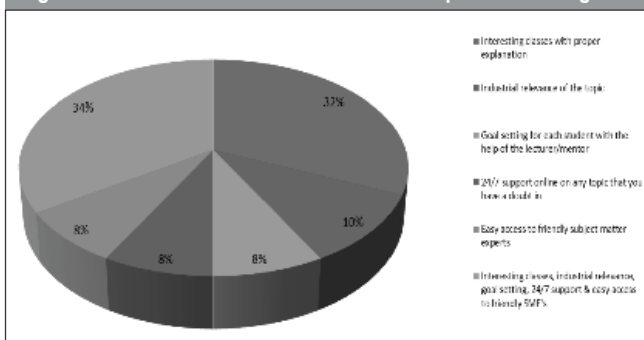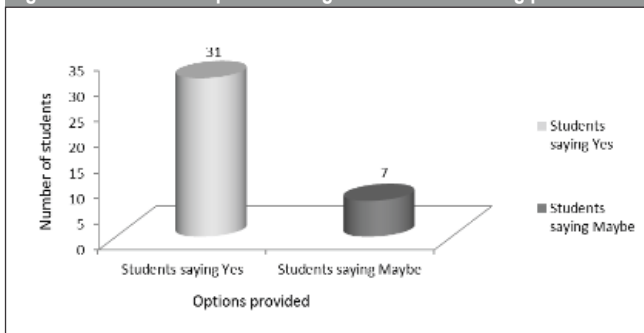
mentally prepare them with the best approach to do the course, how to prepare for the class, internal and external examinations, and other expectation of the college and university. The other area that is included in orientation program is information about job opportunities after completing the course, the career decision that one has to make, the companies that can provide them the requisite jobs, etc.

The class attendance as per the university curriculum should be more than 70% to ensure the eligibility of the students to appear for the final exams. The results showed that all the students in the present study met this requirement. The researchers attempted to understand the current study pattern of the student's in order to draw parallels on the gaps that needed to be addressed to provide better support to the students in their learning habits. Fig. 3 showed that only 37% (N=13) of the study population studied regularly while 63% (N=24) of the students did not study regularly. On further analysis, the researchers found that 55% (N=21) of the students studied for a period of one hour every day, while 10.5% (N=4) of the students studied for 2hrs per day and 8% (N=6) of the students studied for 3 and 4hrs respectively (see Fig. 4). The researchers noticed that the students were confused between "study-time" and "time taken to do assignments" for the next day's class. To understand this study-time better, further discussion with the students showed that according to students "study-time" is the time taken to do the assignments as well as reading activity for the next class. While it is a well know phenomena that all students tends to study more towards the last one week, there were no studies conducted in this line to understand the study behavior of pharmacy practice students, before the internal and external exams. It was observed that 47% (N=18) of the students studied for more than 5 hours in a day while 26% (N=10) of the students studied for 4hrs and 16% (N=6) and 10.5% (N=4) of the students studied for 3 and 2hrs respectively. It was interesting to note that not a single student studied for one hour per day . The students described that they will be very stressed during the time of examination as they find it difficult to complete the entire portion and score good marks in the internal examination (see Fig. 5). The same results were emphasized through the study findings shown in Fig. 6, which shows that the students did not study regularly throughout the course. Majority of the students (53%, N=20) reported to study only during the final week before the internals while 24% (N=9) and 16% (N=6) of the students would start studying 2 and 3 weeks respectively before the internal examination. It was also observed that a 74% (N=28) of the students reported to study for 5 or more hours one week before the final examination (Fig.7). On further discussion with the students, the researchers could understand that the reason for not studying regularly was just laziness. The students in the study group agreed to this as well.

The researchers tried to find out the activities that would provide the students with maximum learning through the questionnaire. As shown in Fig. 8, it was observed that 34% (N=13) of the students learnt relevant information (core concepts) through discussions between the students in class, while 29% (N=11) of the students said that they learnt during the internal examination. This was found to be the most effective way of learning and our observations are similar to the results reported by a number of studies.[1, 2, 7-11] Around 18% (N=7) of the students said that they learnt the relevant topics during seminars and final examination. This could be because of the sheer wish to perform better among the peers and get better marks than usual. It is a well-known phenomenon, which is true with all individuals to fear the unknown. Lack of confidence about the test and the resulted outcome, triggers the need to perform better towards an exam. This can be true as the students had to unknowingly follow the PSQ3R principle of learning (Plan, Scan, Question, Read, Recall, and Recite) for giving the seminar.[12]

The researchers felt that the reason some students would like certain subjects over others would be due the liking that they would have developed over a period of time due to their ease of understanding the subject. In this study, the researchers found that 40% (N=15) of the study population had liking for Pharmacotherapeutics while 34% (N=13) of the students liked Pharmacology and 26% (N=10) of the students liked Pharmaceutics over other subjects during their graduate studies as shown in Fig. 9. It was attempted to analyze the reason why students developed this liking to certain subjects and it was observed that 29% (N=11) of the students liked the respective subjects as the lecturer/faculty members made the subject interesting for them while teaching. On the other hand, 71% (N=27) of the students said that they found the subject interesting irrespective of the faculty who taught (see Fig. 10). The students said this as they could read and understand the subject clearly during their graduate level. Also, they had teachers during their schooling level who made the fundamentals of the subject clear. On the other hand, 74% (N=28) of the students said that they disliked chemistry, while 10.5% (N=4) of the students said that they disliked Pharmaceutics. The remaining 8% (N=3) said that they disliked Jurisprudence and Pharmacotherapeutics respectively (see Fig. 11). The students were further assessed to know the reason behind disliking certain subjects, 55% (N=21) of the students mentioned that the lecturer did not make the subject interesting, while 37% (N=14) of the students said that they could not understand the subject. Around 8% (N=3) of the students mentioned that they had no one else to discuss the doubts other than the faculty, and they were not comfortable to approach the same faculty member on the same topic again, as this could create a negative impression about the students' academic ability (see Fig. 12).

Inorder to develop a solution for the haphazard learning habits of the students as well as ensuring the basics of all subjects that the student has to complete to successfully complete the course it was important to understand the students perception about what could help them to overcome these factors. Figure 15 showed that 34% (N=13) of the students wanted interesting classes, industrial relevance to the topics, goal setting and mentor support for the year, 24/7 support from friendly SME's inorder to perform better in academics. It was interesting to note that 32% (N=12) of the students said that they will be happy if they could be provided interesting classes with proper explanation and industrial relevance for the topics covered. Around 8% of the students were interested in getting mentor support, support with friendly SME's who will be able to make difficult topics simple and interesting. Figure 16 shows that the (82%), 31 students were very interested to have a single window to monitor their performance with the rest of the class. This single window can also be called as a dashboard of a Learning Management System that will show the students their academic performance compared to other students in the class. The students were told that they will get an opportunity to review key takeaways from each and every lecture, laboratory work, attend online discussions with other classmates on the topics covered in class, work on journal publications with students from other universities and colleges, have opportunities to discuss the industrial requirements with key industry people, etc. It was also mentioned that the "Single Window" will provide the possibility to constantly monitor one's performance online, on a daily, weekly, monthly and yearly/semester basis in comparison to the rest of the class/batch. This system will help the student perform a self-introspection on his/her standing with respect to the rest of the class, in terms of regular performance across all subjects.

Along with the core subjects of pharmacy practice, there is a need to emphasise that the pharmacy students' needs to inculcate utilizing computer technology to keep up with the changing world (utilization of multimedia computers and software technologies). Pharmaceutical and technological aspects requiring graphic representation and mathematical complexities in biopharmaceutical calculations, computer-aided programs can simplify all the topics as required by the university curriculum and the industry. The main aim of digital technology, is to develop excellence in pharmaceutical education and make the student more skilled to suit the modern environment and cater to the needs of rapid industrialization. The oral instructions/lecture mediated instructions, have always been an important method to transfer information from the teachers to the students, but to attract the interactions following new techniques really helps. The best outcomes can be brought by

1. Compact Disk (CD) based or Online Video or Audio lectures: CD or online video or audio lectures that cover the core concepts of the subject can be covered by eminent people from different fields of pharmacy with practical application in pharmacy. It is noteworthy that videos have more far reaching effect than the audio files in education. This will be very supportive in the field of pharmacy education. The industry can prepare some video lectures in their field of specialization for use by the university students which will be available as ready-reckoners that can be visited regularly to ensure that the concepts are embedded strongly into the minds of the students.[1,2]

2. Tele conferences or Video conferences: Tele-conferences or video conferences can be made possible between most universities/colleges; such conferences will enable students to ask questions from eminent people anywhere in the world and also find out the latest research activities that are being conducted in the various branches of pharmacy. The same will also prove as a strong base for conducting joint research activities.

3. Recorded lecture or laboratory experiments in selected topics: This can be a list of lectures or experiments that can be made available in libraries or online for easy access for the students based on the need to recollect.

4. Programmed correspondents between students & universities across the Nation: This kind of interaction and sharing of ideas will surely place the Indian pharmacists on a global platform which will result in developing joint research programs and multiple interactions between researchers and students from different universities and colleges.

5. E-Newsletters: This could be electronic newsletters that will keep the activities and progress of different colleges and groups in the last month and can be made available online.[1,2]

6. Online discussion forums: This will be a place where the students will be able to participate in online discussions related to a particular topic of interest in relation to the university curriculum and gain better understanding about a topic. This will help the student understand the concepts better with the support of an online mentor.

7. Online tests: This will help the student take online tests related to the topic of discussion and constantly get feedback on the answers and improve their scores by repeating the tests till they get 100% answers correct. The feedback system will give the answers with the authentic text book references as mentioned by the university curriculum.

In the international scenario, there are a number of similar studies that have been conducted and LMS's implemented with great success. Mehvar and colleagues has provided their inference that the best method to teach would be to use the

support of LMS to take a blended learning approach to teach the topic of pharmacokinetics. This study showed that LMS used by the instructor in a pharmacokinetics course offered to entry level Pharm.D students helps to e present the relationship among various pharmacokinetic parameters. The tools used during class consist of specific outcomes/ objectives, a reading hand-out, a practice problem as a focus of in-class discussion, several online web-based computer simulation modules, a take-home online assignment similar to the in-class practice problem, and an online in-class quiz. The main benefit with this system was that except for the quiz questions, students are provided with all the tools in advance of the class sessions for this topic and are expected to attend the class prepared to discuss the practice problem. Thus, the class time is then devoted to the discussion of the problem and simulations by both the instructor and students, with minimal didactic lecturing. The students will take a quiz at the end of the class and submit the online assignment by midnight of the day the class is held. The students were able to perform much better than usual with the help of this intervention.[7]

In a study by Hilton, an attempt to examine the effect of learning experiences that utilized digital technologies to support students in using multiple representations and through writing-to-learn activities to create multimodal texts on learning outcomes in chemistry was conducted. The student interviews revealed a number of advantages of using digital technologies, including promotion of higher order thinking, enhanced motivation and interest, the capacity of digital technologies to support and enhance visualisation, and the production of multiple representations in multiple modes. Students suggested that the digital resources allowed them to make links between macroscopic, molecular, and symbolic levels and to include a range of representations in their explanations. Thus, significant findings of the study relate to the importance of digital technologies in generating multimodal texts and representations for instruction, scaffolding, and in student-centered inquiry-based learning.[8]

Cahyadi's study on the benefits of blended learning approach included, teaching elements in the experimental classes like reading quizzes, interactive lecture demonstrations and student discussions. The control class was taught in the traditional style, dominated by an instructor lecturing on concepts and problem solving examples. The cognitive improvement was measured by a standardized test and examination grades. The students in the experimental classes showed significant improvement in conceptual understanding and problem solving skills compared to the students in the control classes. While the experimental groups welcomed the modified instruction, they still held the view that the lecturer should play the dominant role of presenting the material. The students asserted that activities using real-life materials were useful.[9]

Jamero and colleagues attempted to understand better teaching methodology by comparison of Computer-Mediated Learning (CML) and Lecture-Mediated Learning (LML) for teaching pain management to pharmacy students. This study compared the instruction of pain management by CMI vs. LMI. An examination was administered and a student survey was conducted to determine effectiveness and student perception of efficiency and satisfaction with these teaching methods. Mean examination scores were not significantly different between the 2 groups, with 62 (91%) of the LMI group and 46 (94%) of the CMI group scoring $\geq 70\%$ (p=0.73) showing that the CMI method was also yielding good response. However, efficiency and student perception of learning significantly increased in the CMI group giving them more confidence to approach the examination.[10]

Inorder to understand the effects of a comparative model of two lecture delivery platforms in a hybrid distance education program, Ried and Byers conducted randomized, cross over research design to compare the traditional video with a 4-panel platform (it consists of one large window on the computer screen with synchronized video and audio, transcripts of the audio narratives, power-point slides and outlines. This is followed up with a post-test questions session along with feedback and reference) among learners on multiple campuses within one college of pharmacy. The 4-panel teaching tool is considered as the most effective tool in teaching and training the students today. The results also showed that students who did well on the semester's previous two examinations scored higher on the questions related to one part of the topic (schizophrenia) while students with higher Pharmacy College Admission Test (PCAT) scores performed better on the other part of the topic (bipolar questions) when compared to students who preferred the traditional video platform proving superiority of 4-panel teaching.[11]

CONCLUSION

There are common concepts, principles and practices that should be employed by pharmacy education policy-makers to meet the needs of society locally, regionally and world-wide. In India, the profession of pharmacy has received attention from the perspective of an integral part of the healthcare system with the incorporation of "pharmaceutical care". The present survey results from students have shown that there is a clear opportunity to enhance the current system of pharmaceutical education with the help of information technology enabled tools like a Learning management system. This will help in meeting the goals of the student, college, university, state and the country by training the future pharmacists better to cope up with the ever advancing needs of the industry. Such computer and web based

approach/model would result in the application based learning in the area of pharmaceutics, pharmacology, pharmacognosy, medicinal chemistry, pharmaceutical chemistry, clinical pharmacy, etc. which would provide strong foundation for the students to meet the globalized industry needs in India.

A number of universities and colleges have already started using advanced LMS as an effective tool to support the current educational curriculum in pharmacy in developed countries. Such innovative tools will help to meet the demand for producing better pharmacists who will be able to meet the requirements of the industry.

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