Manipal Journal of Pharmaceutical Sciences

Volume 5 | Issue 2 Article 10

1-9-2019

Information Technology In Pharmacy – An Indian Perspective

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Research Article

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Abstract

To get an insight into the current status and need for the incorporation of information technology in pharmacy education for learning, teaching activities, and suggestions, and ways to incorporate technology beneficially into education. The use of information technology is also wide spread throughout the working of pharmacy as well. Since its origin, pharmacy field has seen significant changes that require deliberate modifications in the teaching methodologies. These changes should include the use of information technology (IT) for a better grasping of the knowledge imparted to students. Computer science/IT may be a part of the curriculum of pharmacy in most of the universities, but its implementation in the corresponding field is still in the beginning stage. The introduction of it in early stages of pharma education will benefit students during their professional career. The inclusion and adaption of IT into the pharmacy education will require inputs and acceptability from educationalists, government, universities, instructors /teachers, and by the students as well. IT will be useful not only during the education but will also prepare a job-ready pharmacist.

Key words: Electronic Technology, Information Technology, Pharmacy Education.

Introduction

For a successful communication, there must be sender, a responder/receiver, and a message. When there is an alignment of these three, only then communication is said to be done. When we use verbal communication, then the chances of misinterpreting the message or the loss of message may take place[1]. But, if the medium is the message, then information technology (IT) is used. It will change the perception of the three parties of communication and take the whole concept into some other dimension, where the process of communication will be easy, interesting and graspable. The distance learning is often confused with the IT, though it has been found that it can be wisely utilised in this field as well. It is generally easy to understand upon demonstration and easy for lifelong of learning.

Thornburg suggested that the tools of learning are important for delivering the educational aspects[3]. The use of computers and telecommunications allow for a more interactive, integrated learning environment. Education and information are both continuous processes linked to each other. Pharmacy is a professional course, hence, the need for information round-about is required, although the use of IT have always been limited to automation rather than on implementation and transformation[4]. The institutes of pharmacy education utilise computers for demonstration, filing and documentation purpose. This could be well coordinated with a limited number of computers in colleges. The pharmacy education in India dates back to 1937, with the introduction of a three-year B.Pharm course in Banaras Hindu University. After which, around nine colleges were present till 1963. Now, the number of colleges throughout the Indian subcontinent has increased significantly, but the syllabus revision is still regarded to the paper system[5]. Regulatory bodies like Pharmacy Council of India (PCI) and All Indian Council of Technical Education (AICTE) provide guidelines for the number of computer systems to be present in each college but the practical embracing of IT

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Date of Submission: 17/07/2019, Date of Revision: 29/07/2019
Date of Acceptance: 30/07/2019

How to cite this article: Kar M, Pillai S. Information Technology In Pharmacy – Information Technology In Pharmacy – An Indian Perspective. *MJPS* 2019; 5(2): 62-70.

in routine teaching practice of students is yet to be fully implemented[6]. It has been reported in many articles about how information technology can benefit the education system but the use is still limited. The main challenges faced by the pharmacy institutions may include making decisions related to monetary and personal investments in IT to support the work[7]. In a survey in 2009, the outcome based approach to pharmacy curriculum development in the School of Pharmacy, Chinese university of Hong Kong was done[8]. It was reported that even though academic performance was 100%, revised, courses could be planned with desired outcomes, and it was essentially useful in structuring and achieving desirable learning outcomes. The era of pharmacy education is changing rapidly and technology development has helped into a way towards increasing communication.

The modes of transferring cognition to learners can be done usefully via social networking and the use of newest technology. In a study on the use of social network sites as educational factors, 1000 students from seven universities were taken. About 85% of the students used social networking daily[9]. Out of this, 52% accepted the use of technology for transferring information. In a similar study, the importance of informatics in pharmacy curriculum was analysed. A multi-tiered approach was designed, developed and used in a college of pharmacy in the US,[10] and the responses observed were encouraging.

The search for adaptability and change in teaching learning styles is on-going by educationists, instructors and social welfare, globally. The goal is to find a combination of learning theories and student constructed knowledge with practice objective learning. This will prevent passive learning procedure and will encourage active participation from students in the learning process. This requires proper guidance, resources and environment to encourage students to go towards an independent exploration of the resources with help and guidance from the instructor. This will prevent spoon feeding, alert the brains and will also help the students develop interest towards a particular field. Currently, the acceptability towards new techniques is high with the likes of simulation, debate, group discussions, rounds, Delphi method, role play model, transcript based assignments, project groups, and nominal group method that are being used in education[11].

The scenario in the recent past is rapidly changing and information technology is making a marked impact on the lives of people. It is accepted and used by the industries for automation, information processing, routine works, standardisation, customisation, etc. Slowly and steadily, the use of IT in educational learning is creeping in. The change in pharmacy education is inevitable and needs continuous monitoring. Surveys and studies are going on throughout the world not only in the field of pharmacy and pharmacy education, but also in dental, medical and engineering aspects towards the need of incorporation of IT in the curricula.[12]

Benefits of IT

The advances in technology produce paradigmatic shifts in education. It can alter various aspects of what we can do, what is possible for us, and what we may decide. The 'display and deliver' approach is fast catching up with the 'chalk to talk' approach. Some of the potent areas where the use of IT may benefit students and future pharmacists include drug manufacture, drug design, and discovery of new molecule, screening, identification and analysis and hospital pharmacy. It will also create awareness towards rationale use of chemicals in drug design. 'Computer Aided Learning' (CAL) is now widely used to teach undergraduate and postgraduate students via the use of intelligent tutoring system[13], digital libraries, multimedia based studies, simulation software use, etc[16]. The automation will contribute towards the evaluation of the dosage forms in vitro and in vivo. In the field of hospital pharmacy[14], for the storage of patient records, prescription and prescribing process, dispensing, costing and administration of drugs/medicines, automation in chain pharmacy stores and also for monitoring the patient and to ensure the safety and effectiveness of the therapy, newer technologies may be useful. Knowledge of these technologies beforehand will enable high quality patient care with minimum hassles during manual handling of the prescription[15].

These are just a few examples of how incorporation of IT may help in the pharmacy practice for the future pharmacists. During teaching as well, collaboration will increase between students, pharmacists and professionals, which may help in faster problem solving. It will make the student ready for jobs with a handful of knowledge of IT for hospital pharmacy, academics, industries and telemedicine[16].

Theories of learning

The use of networking will be beneficial to the learning process, and it will be helpful in providing access to social learning, paving way to increased understanding, interaction and communication not only among the students but also among instructors, peers, and professionals[17-20]. There are various stages of learning as mentioned in Figure 1. The stages indicate interaction and understanding between the instructor and learner and are completely based on the faith that develops during the process of learning[21]. This starts from ignorance, to confusion, until mastery is achieved finally on the subject/topic. To use information technology with the purpose of improving and enhancing teaching and learning processes, we need to understand the pedagogy of pharmacy education including the theories of learning. The need for learning can be understood from the concept of Maslow's Hierarchy of Needs and can be extended to the Clayton model that describes motivation as existence, relatedness and growth[22]. The theories of learning may be 'objectivism', which means that the knowledge instructor has is to be transferred to the students and he is the one in control of the rate[23]; 'constructivism' where learning is a process and the instructor supports it, 'collaborism' where learning is through socialisation, group discussions; 'cognitive information processing' where prior knowledge, selective learning and feedbacks[24] are necessary; and finally 'socio-cultarism'[25] where learning is subjective, individualistic and value laden (Table 1 and Figure 2). No particular model may be the best approach and it will totally depend on the instructor, course, time, syllabus, understanding, management, examination pattern, experience, goals, etc. The experimentation of new opportunities and technologies towards access to education is higher than it had been few years ago[26-30]. What the effect will be will depend on the readability of the system towards the change.

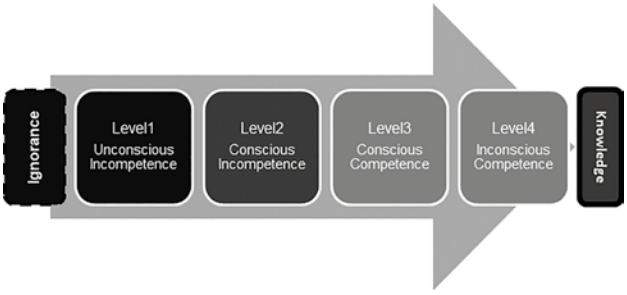

Figure 1: Stages of learning

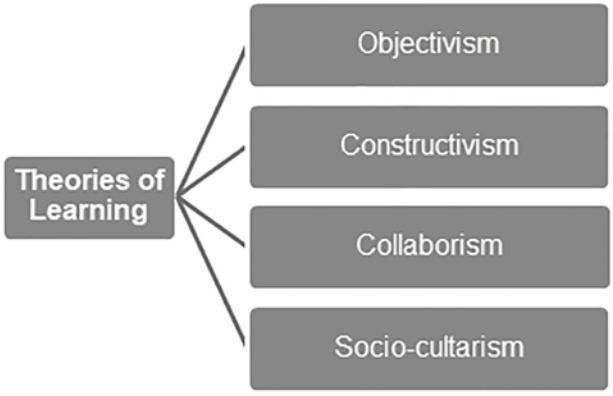

Figure2: Theories of learning

Table1. Example for various theories of learning

Theory	Example	Explanation
Objectivism	Teaching through text books, tutorials	Forces to learn and ignores preference
Constructivism	Transcript based assignments	Understands that the student is knowledgeable and task driven
Collaborism	Role plays	Helps to understand the concept with own discretion
Socio-cultarism	group discussion, observation	The acquired knowledge is applied

Why Information Technology?

Pharmacy education is vast and the students need to learn much, and the instructors have to go through details in a limited time[31]. With the use of technology, teaching will be completed with access to a range of authentic up to date information and learning resources including multimedia, online libraries, data storages, immediate attention, anytime-anywhere/ collective learning. This will also give impetus to

distance education for those students who are unable to attend regularly due to health/financial conditions and the ones with disabilities[32]. The communication channels may improve via emails, blogs, chats, forum etc. This will save time for other works and will also provide maximum exposure of the subject. This is a core matter that will ensure the quality of the educational system with the objectives that it will enhance the overall learning process while also making it easy and available, and since most if not all of the pharmacy jobs in the future will be dependent on it[33].

Most of the pharmacies abroad, especially in the US and the UK, utilise management systems for a routine pharmacist job that include a record of medications, weighing, mixing, dispensing, and costing, labelling, ordering, refilling and stock update. There are various modules like medicine use reviews or prescription interventions available that support these processes. Similarly, the information related to the availability of medicines in a particular pharmacy store may also be retrieved[33-34].

The advances in technology are now a part of daily life. Mobile phones may act as a medium for transference and storage of data. Further, this may be used to send message alerts to the patients for filling and refilling, and may also be used for booking an appointment with the physician or for a check-up. There are apps that are available that may act as alert systems for chronic patients. The dispensing of medications is now not only getting faster by using IT, but the automation has taken this a notch higher by the use of robots for the job. This will prevent the pharmacist's exposure to the hazards of medicines and decreases time in logistics. The hospitals have now started to use electronic discharge systems and barcode identification of patients and medicines. This prevents the misuse of information; reduce the cost of treatment and time as well. The process is also faster[35].

A survey was conducted for the evaluation of the level of perception of faculties, third year pharmacy students and administrators regarding the use of classroom technology that included course management systems, audience response systems, and lecture capture. The results were encouraging with about 86 % of faculties and 91% of the students agreeing to the use[34–37]. In a similar survey, the use of iPad (Tablet) technology towards learning and pharmacy education was studied and the results revealed a positive attitude. In a unique attempt towards the use of information technology in a laboratory during dissection, it was identified that learner engagement, instructional objectives, enhanced effectiveness, and the efficiency of dissection education was present with the use of iPad by the instructors.[38]

The Ministry of Human Resource and Development (HRD), Government of India, has stressed on the use of information technology in the education field and laid various rules for the achievement of the same in colleges. The universities are also showing an increased interest in the incorporation of IT. IT boom is starting to make its presence in the admission[39], examination, and evaluation pattern, where the paper system of evaluation of students is now being replaced with online examinations. This has eradicated late results, manual errors, and is less time consuming. Information technology has also played a role in the regulatory department as the approval and regulations are now submitted online, which saves time and energy. The submission process is easy and do not require the teaching faculties to be involved in it for longer durations, hence, the teaching schedule will not be hindered.[40]

The use of IT will provide access to a range of learning resources via audio-visual education. The use of internet will allow access to online data and libraries. The outlook of the student will improve with the maximum available data, and the dependency on textbooks, which provide limited information, will decrease. Faster access to information will decrease the students' tendency towards acquiring knowledge later. As the information source will be available immediately, it will further help them in understanding the subject better. This will provide anytime learning, independent of the place and time[41].

The use of social media among students is blooming, and if used intelligently it can help in working in

collaboration and the sharing of data. This use of social networking can also be used for providing informative data, assignments, and online lectures by the instructors. The new technology helps enable the shifting at the level of delivery, so that the old technologies are just augmented and not replaced. It is similar to the fact that though we prefer to use computers, the use of books, pen, pencil and/or speech is not obsolete[42].

Learning is highly perceptual in nature, and concept formation and memory can be enhanced with the multimedia approach. This will be useful especially in explaining body functions, drug receptor association, mechanism of drug action, metabolism processes, design of dosage forms, automation of technologies[43] in prescription handling, tabletting technologies, working of machines and other simulation techniques during laboratory demonstrations. As animal experimentation is discouraged nowadays due to ethical concerns, simulation softwares can be helpful in understanding the processes.[44] Education is best when provided to eager, motivated learners. It will make them skilful and the knowledge will stay with them lifelong. The old ritual of stuffing students with data will not stay for long and will not be helpful once they are out of college.

How should IT be incorporated?

The importance of IT is the involvement of students with the subject in broader perspectives. The reengineering of education should take place by the incorporation of sense-full thinking with proper usage of IT. For this, effective designing is required for outlining essential issues, considerations and tasks for instructional development. A complete change in the course syllabi, resources, creativity, activities and projects, which may be collaborative or individual, examination and evaluation pattern is required. Whatever the course material may be, it must enhance the interaction between the teacher and students and peers. This will provide freedom of exploration of alternative styles and pathways of learning. Here, the use of texts, online videos, demonstrations, texts, animations may be helpful[46].

Electronic lectures may be used as simulations to encourage brainstorming, thinking and interaction among students. This must either be interactive throughout or should have an introduction and finally a follow up with questions and discussions. Text documents or outlines or hints of discussion/ lecture may be provided beforehand. The information technology can improvise our vision as a solitary process will now be a social process where the individuality of the students will be retained during the collaboration. It will thus incorporate all the theories of learning collectively while selectively picking the best from the lot. If required, bulletin boards may be used for the study[47].

Some principles may be applied to obtain the best of pharmacy education as[48-57].

The teacher/instructor must be able to adapt to it. Most of all, if the technology suffices the knowledge required to teaching the students then it will be embraced. For this, communication platforms are required that will enable dynamic communication with students including mobile apps, social networking sites etc., that can assess the students' work and provide planned databases.

1. It must not be forced but be introduced as a part of lesson planning and execution. This will help in systemic adoption of technology at the college level. The general notion about the use of IT is that it will be expensive and complicated to use. Hence, the planning should be to get easy, secure, stable yet flexible, compatible and open platform for use.
2. Use of online methods for student evaluation. Paper evaluation techniques are traditional, but online evaluation will supplement towards the demonstration of growth including interactive videos, online chats, etc.
3. A standard protocol for these methodologies must be used so that the quality is not compromised at any cost. This has to start at the university level where routine teaching could be done through online videos of lectures, presentations from eminent people of the field, discussions with the concerned faculty, online evaluation of theoretical and practical knowledge of the students.

4. Technology is not a substitute for teachers but the online materials that are available are many times more than what is available in print.

5. Electronic systems are more efficient and lesser time consuming compared to the paper documentation related to study, evaluation and understanding. The students need to learn and apply to use various documentation skills that can help them turn these into a habit on the professional front. It will further help in the student's assessment of competency, and this may be recorded and highlighted in the student portfolio for their worth.

6. Monaghan and co-workers did a cross-sectional survey to understand the types of educational technologies that are used and to identify the resource individually at the institutional level. It was identified that micro-blogging was the least preferred and used by students, while the use of IT in course management system was maximum.

7. The introduction of animal experiment simulation software in laboratory will increase the interest of students. It will also help in understanding the basic mechanism principle behind the experimentation.

8. The calculation of drug release from dosage forms, release mechanisms, and formulation of dosage form based on these supportive data may be done on MS Excel and other software that are available online or those that may be downloaded free of cost or by paying a nominal amount.

9. The attendance of the students may be done via thumb impression of card scanner, which may be linked to their mentors or parents for information. Similarly, it can be useful in understanding the interest of students in different subjects and aligning the education towards that.

10. The application of IT system in pharmacy has now been started as a course in pharmacy education as pharmacy informatics. This deals particularly with biomedical information, data and knowledge.

West and Bleiberg on behalf of Brookings Institution, Washington[58-59], suggested that advances in technology may enable dramatic changes in the education content, delivery and accessibility. It may improve learning, understanding, sharing, communication and mastery of instructional material. This will exponentially increase the knowledge.

Conclusions:

The quality of teaching will improve upon integration of IT, and it is required that the persons involved must be familiar with the usage and be acceptable towards the change. The need of the hour is to embrace information technology for teaching, learning, documentation, examination and similar works. Combined efforts from all fields of education will bring about a difference in pharmacy education. Information technology offers a large number of choices; however, it must be ensured that the technology could be harnessed for learning and professional aspirations.

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