INTRODUCTION OF SELF DIRECTED LEARNING TO UNDERGRADUATE STUDENTS IN PHARMACOLOGY.

Suneel. I. Majagi*
Associate Professor and HOD Department of Pharmacology, Gadag Institute of Medical Sciences Gadag-582103. Karnataka- India.

ABSTRACT

Introduction: Medical college teachers stress on factual teaching rather than facilitated teaching in India. Constant interest to be in touch with newer methods, research and technology has to be developed. Therefore students need to develop skills in reflecting on what they need to learn and where to look for information. Undergraduates in second phase M.B.B.S will be novice learners in pharmacology subject and are little aware of self directed learning (SDL). Introducing SDL to these students will be an innovative effort. Methods: Goal of the study is that an undergraduate student should be able to carry out SDL effectively at the end of second phase M.B.B.S. Standard theories and models of learning and instruction will be used to design the methods. Interactive lecture, tutorial, group discussion, learning project, problem based learning like exercise etc will be used to teach and practice the principles of SDL. Students will be regularly assessed by their performance while carrying out the SDL. Results and Discussion: This programme regarding SDL will be able to convert initial extrinsic motivation of incorporating SDL into intrinsic motivation. Thus the student can become a lifelong learner by incorporating the principles of SDL. Present paper is a conceptual study and practicability of the study has to be confirmed. Similar education research may be carried out in other disciplines also.

KEY WORDS: Active, Instruction, Learning, Pharmacology, Self directed learning, Undergraduate.
INTRODUCTION
With the rapid evolution of health care knowledge, medical practitioners must upgrade the clinical practices they have learned in order to provide optimum health care. However, physicians are often unaware of new practices and procedures and frequently fail to incorporate advances in medical knowledge in their practice.\cite{1,2,3} There is a need for health professionals to develop constant interest to be in touch with newer methods, research and technology. Therefore students need to develop skills in reflecting on what they need to learn and where to look for information.

Abraham Flexner persuaded the medical establishment of his time that teaching the sciences, from basic to clinical, should be a critical component of the medical student curriculum, thus resulting in “preclinical curriculum”.\cite{4} Goals of pharmacological education include many objectives like training one in selecting criteria for effective and safe drug use in patients, training in clinical skills required for practicing effective pharmacotherapy and improving prescribing efficiency.\cite{5} Professional skills like communication skills, prescription writing skills, critical appraisal skills, community related skills etc., have to be developed, which will enable a doctor to perform his expected duties efficiently.\cite{6} In medical colleges, pharmacology course has to keep pace with the rapid changes as well as requirements of clinical practice.\cite{7} Teaching of pharmacology has been more focused on factual information rather than emphasis on clinical and applied aspects. Nebulous nature of many of the new drugs makes the teachers cautious of teaching pharmacology of drugs that have been recently introduced in the market.\cite{8} Need for undertaking educational research to find out success of newer interventions has been stressed.\cite{9}

In India most of the teaching for undergraduates in pharmacology subject consists of passive learning involving didactic (factual) lectures with lack of interaction between the teacher and the student and rare use of tutorials.\cite{10} Many pharmacology teachers are aware of non traditional teaching and learning methods and strongly feel that they are both appropriate to the discipline and effective in producing learning gain in the students.\cite{11} Attitudes strongly influence the behaviour of a person.\cite{12} Need for developing the habits and skills of critical thinking has been stressed for medical practitioners.\cite{13} Improved access to educational materials is crucial, as learning is often an unplanned experience.\cite{14,15} 80–100% of adults engage in some form of learning activity throughout their lives, but only 20% of these do so in a formal educational setting.\cite{16,17} These articles reveal the scarcity of self directed learning.
What is SDL? Knowles defined self-directed learning as a process in which individuals take the initiative in diagnosing their learning needs, designing learning experiences, locating resources and evaluating their learning.\textsuperscript{18} SDL is an internalised process related to motivation and self-identity, something that happens within a person, not something that is done to them.\textsuperscript{19,20} History of SDL can be said to date back to the ancient Greek philosophers.\textsuperscript{21} From the viewpoint of physicians’ behaviour for patient welfare, two crucial dimensions viz., scientific-technical and socio-emotional are emphasised.\textsuperscript{22}

Why self-directed learning? SDL has been shown to be associated with increased curiosity, critical thinking, quality of understanding, retention and recall, better decision making, achievement satisfaction, motivation, competence and confidence.\textsuperscript{23,24,25} SDL is being the most natural form of learning which may involve meta-cognitive processes which may depend upon personality type, self belief, learning style preference, cognitive style, reflection-in-action, past experiences, situation pertaining, subject studied, acquired competencies etc.\textsuperscript{26,27}

Medical students had less sophisticated information commitments indicating the need for additional training and that medical educators implementing internet-assisted instructional activities need to find some methods to help medical students, so that students can get accurate information relevant to their academic goals.\textsuperscript{28} Several studies outside of health care have revealed that most often e-learning is at least as good as, if not better than, traditional instructor-led methods such as lectures contributing to demonstrated learning.\textsuperscript{14,29} Updating electronic content is easier than updating printed material.\textsuperscript{30} By enabling learners to be more active participants, a well-designed e-learning experience can motivate them to become better engaged with the content.\textsuperscript{31}

By considering these reports and the needs of medical education, the present study has been proposed. While designing the course standard theories and models of learning and instruction will be used.

**Objectives of the study:** After completion of SDL programme/course (at the end of II phase of M.B.B.S) an undergraduate student should be able to:
1) Define SDL exactly as stated by Knowles.
2) Identify at least five sources of information.
3) Rank SDL (≥ 3 on a scale of 4) as an important tool for learning the subject.
4) Compose answers by using principles of SDL to questions drawn on a given theory topic to the accuracy of ≥70%.
5) Assemble answers by using principles of SDL to questions drawn on a given clinical problem (PBL like exercise) to the accuracy of ≥70%.

MATERIALS AND METHODS
Introduction of SDL will be done mainly by using David Merrill’s first principles of instruction, Kolb’s model and Bloom’s taxonomy of educational objectives will be used.\(^{[32,33,34]}\) (Fig 1, Fig 2). Methods are arranged according to these theories. Aim of teaching SDL will be to make self directed learners to: take primary responsibility for their own learning, accurately identify their own learning needs, clarify their learning goals and objectives, successfully identify and use resources and educational strategies that can help them to achieve their goals and objectives, accurately assess their achievements as well as repeat the learning cycle if necessary.\(^{[18]}\)

![Figure 1. Experiential learning cycle](image)

Figure 1: Kolb’s model depicting experiential learning cycle.\(^{[33]}\)
Figure 2: Bloom’s Taxonomy.


The methods are designed in such a way that students will be engaged in solving real world problems (PROBLEM CENTERED) which will promote learning. Students’ knowledge about SDL will be assessed by conducting brainstorming sessions. Interactive lectures will be conducted regarding definition of SDL, the importance of SDL, information literacy, various information resources, requirements of health professionals and how SDL can be used to keep pace with the recent trends. These will cause ACTIVATION, i.e learning is promoted when relevant previous experience is activated.

Examples of performing SDL will be demonstrated to the students by the teachers. These involve:--- Problem identification: how to ask good questions or set clear goals or objectives, Problem solving: ability to determine what needs to be learned in order to answer those questions or determine needs to gather information, ability to identify appropriate resources for learning and ability to use the sources effectively i.e., to use a systematic approach to problem solving (organizational planning) and decision making. Peer persuasion: ability to report and discuss what was learned. Through interactive lectures teacher will discuss (inquiry between the student and the teacher) about required competencies for carrying out SDL and learning plan design. Role play and standardised patient can be used to demonstrate SDL to the students. Here the teacher will perform as a facilitator and a resource to self-directed learners and as a procedural guide rather than content transmitter. These exercises
will promote learning due to the involvement of DEMONSTRATION. Each student will be given questions like M.C.Qs, Short notes etc., in small group study or tutorial, where in he/she will find answers by performing SDL through targeted reading, referring library books & journals, e-learning etc. Student can also briefly report about the sources used, the search time required etc., to the teacher/s. Seminar presentations by the student on a theory topic and PBL like exercise will be conducted (Exercise I and II). Here the teacher performs as a facilitator and a resource to self-directed learner. A comparison of assumptions and processes, relationship-building exercises and content-course assessment will be done. These exercises involve gathering information proactively from books, library, e-learning, human resources and finding evidence for different objectives. These exercises involve APPLICATION phase where learner is required to use his/her new knowledge or skills to solve problem which inturn will promote the learning.

There will be instructor-led e-learning where all learners receive information from the instructor and a member in the group can communicate directly through e-mail with other members towards preparing their topic.

After collecting information by performing SDL through literature survey (research) the student will be organizing the content and prepare the power point (synthesis) for presentation. Group discussion and presentation involving real life cases (PBL like exercise) will also be organized. Student will use instructional design and pedagogical principles to determine learning objectives and to produce instructional materials (power point etc). Each student will be presenting his/her topic in the full class. Here INTEGRATION will take place as learners are encouraged to transfer the new knowledge or skills into their everyday life. Each student will be analysed of his competencies as a self-directed learner by the faculty members in a standardized assessment form.

As mentioned earlier following are the learning contracts/projects assigned to the students to promote SDL and active learning.

**Exercise I:** The students of II phase M.B.B.S will be divided into different groups. Each group will be assigned a “topic” which will be covered for the first time. For ex: Essential drug concept and principles of rational use of drugs, Recent advances in Anti-diabetic drugs, Antihypertensive drugs, General Anaesthetics and Local Anaesthetics, Psychopharmacology, Anti-malarial drugs etc.. Each member of the group will be assigned a subtopic. Each student
reviews his/her subtopic by referring to related books in the library, consulting the experts in that field, using e-learning etc., Each faculty will be allotted equal number of presenting students. Pre final copy of the power point presentation will be shown to the concerned teacher in the department of pharmacology, who will suggest the corrections to be made in the power point before presenting in front of the whole class.

On the day of presentation (3 Hours duration) chosen group will be presenting their topic (and subtopics) in front of the full class consisting of 130 students of II phase M.B.B.S. Presentation of each subtopic will be followed by interaction sessions between the presenter and the students and the staff. Each presenting student will be assessed by each faculty of the department in a standardized assessment form. This exercise may promote collaborative learning. Students discuss among themselves and also with their teachers. Active involvement of teachers throughout this exercise makes it a consultation skill-practice exercise with guidelines for stating objectives, relating methods to objectives etc.

**Example of Exercise I**

**Main Topic:** Recent advances in management of hypertension and its subtopics (Table 1).

**Table 1: List of subtopics related to recent advances in management of hypertension.**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Roll Number of student</th>
<th>Sub Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>82</td>
<td>Patho-physiology and classification of hypertension.</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>Classification of drugs.</td>
</tr>
<tr>
<td>3</td>
<td>103</td>
<td>ACE inhibitors.</td>
</tr>
<tr>
<td>4</td>
<td>69</td>
<td>Angiotensin receptor antagonists.</td>
</tr>
<tr>
<td>5</td>
<td>93</td>
<td>Calcium channel blockers.</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
<td>Diuretics.</td>
</tr>
<tr>
<td>7</td>
<td>54</td>
<td>Beta adrenergic blockers.</td>
</tr>
<tr>
<td>8</td>
<td>123</td>
<td>Alpha adrenergic blockers.</td>
</tr>
<tr>
<td>9</td>
<td>45</td>
<td>Beta and alpha adrenergic blockers.</td>
</tr>
<tr>
<td>10</td>
<td>86</td>
<td>Central sympatholytics.</td>
</tr>
<tr>
<td>11</td>
<td>14</td>
<td>Vasodilators (arteriolar and arteriolar + venous).</td>
</tr>
<tr>
<td>12</td>
<td>26</td>
<td>General principles of management of hypertension including combination therapy and newer guidelines (other than WHO).</td>
</tr>
<tr>
<td>13</td>
<td>10</td>
<td>Management of hypertension in special cases like pregnancy etc.,</td>
</tr>
</tbody>
</table>
Exercise II: For case oriented learning (PBL like exercise), after presentation of theory topics, another round of similar exercise will be carried out wherein theory topic will be replaced by a real world/clinical case. Each member of the group will be assigned a subtopic like patho-physiology of the disease, eliciting history, sign and symptoms, investigations needed, differential diagnosis, treatment including pharmacotherapy etc. Each student will review his/her subtopic by going through concerned books in the library, using e-learning, referring journals, consulting clinical teachers and the experts in the field etc., Students can take help of an assigned teacher who acts as a facilitator.

On the day of presentation (3 Hours duration) one group will be presenting their clinical problem (and subtopics) in front of the full class consisting of 130 students of II phase M.B.B.S. Concerned experts from clinical departments or pre or para clinical departments will be invited. After presentation of each subtopic there will be interaction session between the presenter, students, staff and the experts invited. Each presenting student will be assessed by each faculty of the department of pharmacology as well as by the experts from different departments in a prescribed {preparation in terms of depth, extent(including recent advances), slides; presentation in terms of order, clarity, confidence, use of audio visual aids; ability to respond to questions etc} form. Invited experts from different departments will try to full-fill the gaps in the teaching by addressing the students.

Example of Exercise II (PBL like exercise)
A 50 year old female comes to the clinic with complaints of anorexia, nausea, vomiting, increased urine output, abdominal pain, altered consciousness. How do you diagnose and treat the case?

The experiential learning model of Kolb states that learning involves four processes viz., Concrete Experience (C.E), Reflective Observation (R.O), Abstract Conceptualisation (A.C) and Active Experimentation (A.E).[33] Various methods used for teaching and learning SDL in the present study belong to different processes of Kolb’s model (mentioned in parenthesis) viz., Brain storming sessions (C.E), Interactive lectures regarding the definitions etc(C.E), Demonstrations of SDL(C.E, R.O), Interactive lectures regarding various competancies required for carrying out SDL(R.O,A.C.), Role play (C.E,R.O),Standardized
Categories in the Bloom’s taxonomy of educational objectives include knowledge, comprehension, application, analysis, synthesis and evaluation which represent progress from lower order thinking skills to higher order thinking skills. This classification of levels of intellectual behaviour is important in learning. In the present study the methods for learning will be so designed that the student progresses through all the steps beginning from knowledge towards synthesis and evaluation.

**Evaluation:** A pre test will be conducted with the help of 10 validated M.C.Qs at the beginning of the course to assess knowledge about SDL. The same M.C.Qs will be used as post test after the course. The pre and post test scores will be compared by using statistical analysis (p<0.05 will be considered as significant). Regular feedback from the students and other faculty members can be obtained to rectify lacunae, if any, in the procedure of teaching and learning SDL. After completion of the course a test (examination) will be conducted which will have evaluation questions in congruent with the objectives. A computer online test for evaluation can also be conducted to orient students towards computer based learning.

A student should be able to carry out SDL not only in II phase M.B.B.S but also during III phase M.B.B.S and internship. This may be reinforced by six monthly sessions conducted by the department of pharmacology in collaboration with faculties of clinical departments. Here PBL will be given importance.

Ethical clearance can be obtained from the institutional ethics committee for human subjects for this project.

**RESULTS AND DISCUSSION**

In this study there will be involvement of brain storming sessions and interactive lectures where in student-teacher inquiry sessions as well as group tasks are involved. Reflection on experience will be elicited in the tutorials or small group discussion. Feedback on performance will be given through other peers and the faculty members. Learner’s interests are maintained in the active learning which provides a means for individual practice and
reinforcement. As a result there will be a new shift towards active learning and learner centred model which changes the focus from a passive learning and teacher-centred model. This is essential as most of the present teaching in India is done through didactic lectures or factual teaching which involves passive learning.[10]

In the present study many information sources are involved like library books, journals, internet, faculty, peers etc. Information seeking is the process by which users find and select proper information resources in order to enhance their knowledge level.[35] Internet can be used to search information on the web for achieving the academic goals. E-learning is also called as internet-based learning, web-based learning, distributed learning, computer-assisted instruction or online learning. In many medical schools digital libraries have been established as in our institution to manage access to e-learning materials. Even though many universities now use the internet, telecommunication technologies and multimedia programs as part of educational training in the classroom.[36,37] there is lack of such system in our setup. Internet serves as an important resource of information and in the present study the students will be taught how to search for the information in the web by using live demonstration techniques, accessing the data bases etc. Health information is more and more readily available for users on the internet with the rapid growth of medical information websites.[38] which will be an important source of information to the learners while dealing with learning projects (Exercise I & II).

Problem based study involved in the present study will be benefitted by e-learning as web-based resources supply regular professional updates regarding evidence-based patient care information and medical problem solving.[39] Inclusion of e-learning will help in retention, better utilization of content, better achievement of knowledge, skills, attitudes and offering learners the flexibility to accommodate their diverse learning styles.[40,31] Skills in creating e-learning by the faculty may differ from those needed for traditional teaching, which may involve personalized instruction using both adaptive and collaborative learning.[41]

During Exercise I and Exercise II students will be performing self assessment, formulating questions and answers, seeking information, doing critical appraisal, taking clinical decision etc. In PBL like exercise (Exercise II) learner groups are presented with a real life case which involves elaboration of previous knowledge, setting of their own learning objectives, acquisition of new knowledge and application of the knowledge to problem solving. There will be involvement of collaborated learning in these exercises. A higher level of satisfaction
has been reported by the learners by learning through PBL.[42,43] In PBL like exercise apart from active learning, clinical decision making, ethics, humanism, cost effectiveness will also be stressed.

SDL has been an essential issue in medical education due to the expansion of knowledge, accessibility to information and greater emphasis on reflection. In SDL, active learners learn more things more efficiently, to retain that knowledge better, and to use it more effectively than the passive learners.[18] Goals of SDL should be in the socio-emotional aspect of patient care.[44] and patients’ unmet needs and doctors’ educational needs may result in reflection-in-action.[27]

In this study two exercises (I & II) are involved to reinforce the SDL.[45] Brookfield (1982) points out that SDL alone has less successful outcomes than a mix of self-directed learning and group learning. Present study utilises small group study, tutorials, seminars which will promote collaborative learning among the students. This will promote higher levels of learner satisfaction, improvements in knowledge, self-awareness, understanding of concepts, achievement of course objectives and changes in practice.[46,47]

Innovations in e-learning technologies point toward a revolution in education, allowing learning to be individualized (adaptive learning), enhancing learners’ interactions with others (collaborative learning), and transforming the role of the teacher (facilitator).[41] Teachers can also use numerous opportunities from e-learning towards documenting the scholarship.

As described earlier, standard theories and models of learning and instruction will be used and this will help towards making SDL programme a success. Kolb’s model of experiential learning has been involved in SDL.[27] If the present study is implemented practically then it may help to convert extrinsic motivation of performing SDL into intrinsic motivation and future medical professional will become a lifelong learner to cater to the needs of the patients as well as the students if he becomes an academician. Apart from this, students will be trained in peer communication, consulting the faculties, pedagogical science {prepare and deliver the seminar (power point presentation) in front of classroom}, to be ready for interaction sessions, e-learning and above all become lifelong learners. In future SDL may be incorporated in the University curriculum.
This paper is a conceptual study and practicability of the study has to be confirmed. There may be some practical difficulties which can be encountered while incorporating this study. Initial investment in terms of human resources, time and cost has to be considered. Teacher will have to involve himself in this programme by considering the importance of ramifications of thoughts, plans, decisions, actions, self-reflection, self-evaluation, metacognition. Even a digital library with few computers exist, students should be made available of more computers if required. There will be significant set-up costs involved in designing and implementing an online module, although the costs will diminish following an initial set-up.\(^{[49]}\)

**CONCLUSION**

Teaching and learning of SDL will be done by using David Merrill’s first principles of instruction, Kolb’s model and Bloom’s taxonomy of educational objectives. This programme should be able to convert initial extrinsic motivation of incorporating SDL in undergraduate student into intrinsic motivation so that he/she will become a lifelong learner by accommodating the principles of SDL. This will cater to the needs of him/her as a health care professional, his/her patients as well as the students (in case he/she becomes an academician). This is the need of the day as there is constant and continuous growth in the field of medical knowledge and practice. Prospective medical professionals will be benefitted by self-reflection, experiential learning and even they can evaluate their own learning. Future research is likely to focus on outcome of evaluations of SDL and how it may affect learner knowledge, skills or attitudes. Similar education research can be carried out in other disciplines also.

**ACKNOWLEDGEMENT:** My sincere thanks to Mark Gelula, Research Assistant Professor, Curriculum Department of Medical Education, University of Illinois at Chicago (UIC), U.S.A.

**REFERENCES**


