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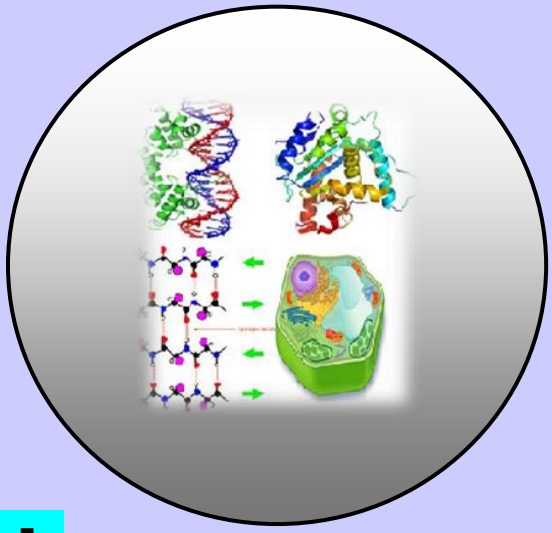

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REVIEW ARTICLE

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Tools to Improve Medical Education and Research at Undergraduate Level

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ABSTRACT

The contemporary thinking in Medical Education lays emphasis on 'Teaching – Learning', as opposed to the greater importance previously attached to the 'Teaching' alone. We are now more interested in understanding what and how students learn , why some of them do not learn and when do they learn better . Hence, the attention is more focused on Learning and Learner. The medical Education Unit works in the direction to help the Medical Teaching Faculty to be a better teacher, research worker and clinician as well as to evaluate and assess the medical students in a better way. Medical Education Unit also arranges for continuing Medical Education (CMEs) programs, medical workshops, publication of medical journals and magazines etc. Thus Medical Education Unit has definite motives and it works in the direction to help the teacher to be more effective person, a classroom leader, a practitioner of human values and a facilitator of change.

Assessment is an integral part of Teaching – Learning process. Methods of assessment should be selected in conjunction with the teaching methods. The best of examination employ a mixture of a few devices of assessment.

Key words: CME, Blackboard, Overhead projector, Computer, Seminar & Assessment.

INTRODUCTION

Setting the space for new trends in medical education is a vital segment for the development of excellence in all aspects of the health care system. It is vital in itself and also strengthens the other segments, viz. patient care and research.

In the other words of Sir William Osler, "A class of intelligent young men or a group of clinical clerks in the world is a stimulus to the attending physician, a great help to the house officers and an unmixed blessing to the patient. Between teaching and research also, there exists a mutually beneficial relationship."

Teacher for medical science –

A teacher is helped in his research by the periodic review of literature with his teaching responsibilities compel him to undertake. On the other hand, a research worker makes a better teacher because he retains a healthy curiosity. As Walter Cannon says, "Teachers who are investigators filled with an ardors for discovery and acquainted with ways to nature's hidden secrete arouse in young man, the qualities they themselves possess."

These methods are essentially the ones inherited by them from their own teachers.

The role of a teacher is not of bossing and being authoritarian. The role of a teacher is to be a considerate and a friendly person, who creates an appropriate atmosphere for effective learning, so that learning is an enjoyable and a pleasurable process ***(1.Tejinder Singh et al, 2013).***

In general, the teachers have no formal background of skills in education methods. They acquire some sort of art of teaching while they are students, and perhaps improve their methodology as they grow in the profession ***(2.Chandra, 1983).***

Teaching

Teaching is an interaction between a teacher and student under the former's guidance in order to bring about expected changes in later's behavior.

The purpose of teaching is to facilitate learning and encourage the learners to learn more effectively . The purpose of teaching is not merely dispensing information , but to develop skills and attitude also ***(3.Tejinder Singh et al, 2013).***

Learning

Learning is a process resulting in some changes, or medications in the learner's way of thinking, feeling & doing as a result of practice. The changes may be temporary, or permanent ***(4.Tejinder Singh et al, 2013).***

Explosion of information and technological advancements which have occurred during the past two decades or, so, have changed and broadened not only the contents of education but also the attitudes of students. The vastly increased information needs to be imparted now and require technological innovations over and above the classical audio visual aids. A number of these emphasize the importance of self learning, for example tape-slide sets and programmed texts. The usefulness of computer for stimulating education exercises / tutorials is now well recognized.

Changes in attitude are occurring at a rather rapid rate. Hence a discussion of education methods by the teacher of medical sciences is deemed opportune and that essentially an exercise in sharing our thoughts and pooling our experiences ***(5.Manchanda, 1983).***

Lecture

Lecture is one of the most cost effective method which can transmit a large amount of information to a large number of students ***(6.Tejinder Singh et al, 2013).*** The 'lecture' seems to be a very trivial topic to talk on .

Lectures are of two kinds. **One**, in which we present research data, the **other**, in which we teach, the students, the lecture of undergraduate students should provide information tailored to the student's level. The lecture should identify and emphasize local norms, disease patterns etc. Simplicity of language, optimum volume, reasonable slow speed and a nature, conversational variation of tone is also helpful.

Lecture, can stimulate interest in subject by

1. Presenting the subject with proficiency,
2. Tailoring the subject matter to the needs of the students,
3. Pointing out the relevance of the subject,
4. Altering the course in response to the student's reaction,
5. Selective recall and repetition to ensure through grasp and
6. Appropriate showmanship.

Use of purposeful movements of body and hands are also helpful for emphasis of the material. Lecture should be prepared to create curiosity and interest to the students, having clear and relevant examples, and the materials should be summarized periodically. Also it is very important that lecture should be finished before time.

[A] TOOLS FOR MAKING LECTURES BETTER

Visual aids, like pictures, methods, charts, diagrams, aids have to keep pace with the scientific advances. The only legitimate use of aids is to make good lectures better.

[I] Blackboard: of all education aids, blackboard is perhaps the oldest, and most widely used.

Advantages

1. Readily available in most of lecture rooms,
2. Electricity is not absolutely necessary for its usage,
3. Sequential development of a concept can be done effectively,
4. Initial and recurring expenditure is minimal,
5. Easy to use (and misuse!!),
6. Darkening in room is not necessary.

Limitations and Disadvantages

1. Eye to eye contact is lost while writing (momentarily)
2. The written material cannot be stored and re -used,
3. Advanced preparation of material is not possible.

For use of blackboard, good quality of board and chalks should be used. Having chalks of different colors is helpful to be appropriately used. Sufficiently large letters should be written on board. And we should never forget to clean the board at the end of lecture.

[II] Overhead Project

Though blackboard is still the commonest visual aid used for teaching, there is a trend to switch over to the overhead projector (**O.H.P.**)

The over head projector is a device for projecting matter on transparent plastic sheets (25X20 cm) on to a screen. It uses a lamp, lens and mirror arrangement. Versatility of the O.H.P. has made it a powerful teaching tool and it has largely replaced the blackboard in the classroom of affluent countries ***(7.Tandon, 1983***).

O.H.P. has several advantages over the blackboard

1. Surface area is limitless,
2. Material (including illustration) can be prepared well in advance,
3. The teacher faces the class all the time and eye to eye contact is not lost,
4. The teacher's transparencies can be preserved for future use.

The O.H.P. also has several advantages over Slide projector.

1. There is no need to darken room (the students may stay awake!!),
2. Progressive disclosure is very easy,
3. The services of a projectionist are not required,
4. Material can be prepared at short notice by the speaker,
5. The material on the stage of the O.H.P. can be manipulated, added or altered in way that is not possible with slides.

A little effort and imagination greatly improve the effectiveness of O.H.P. A few hints and suggestions are here;

1. The project screen arrangement has to be such that every student in the class can see every part of the projected image with ease. The screen may be placed at a higher level than the speaker (directly behind him,) , oa , in , one corner of the room with the projector diagonally in front of it.

2. Ensure that the smallest letter on the screen can be read comfortable by the person in the last rows. Each letter or character on the transparency should be at least 8-10 mm high. There should be no more than six words in each line and no more than eight lines in each transparency. Normal handwriting is just not enough . The use of a template is strongly recommended.

3. It is best not to project the entire transparency at the very beginning . Optimal 'progressive disclosure 'of information achieves the same objective as the sequential presentation of information on the blackboard.

4.Three or four transparencies can be used as overlays on the original transparency. This technique is very effective method of 'building up' or 'dissecting down' a complex diagram.

5. The pointer must be laid flat on the transparency and not waved around.

Felt – tipped pens specially made for use with O.H.P. transparencies should be used. We should never leave a visual on the screen after a point has been made and equally important , we should turn off the projector light , keeping the running , when we are not actually projecting a transparency . The bright screen can be distractor and the projector gets overheated if light is left on for too long.

The best colours used to write on transparency are black , blue and green . Use of red should be spared as it is not a colour that projects well.

[III] Slide and Slide Projector

Slides are the frequently used visual aids in communication.

Advantages of Slides

1. Can express clinical and Operative findings.
2. Easy to carry.
3. Can be preserved for long time

Disadvantages and Limitations

1. We have to darken the room,
2. Progressive disclosure is difficult,
3. Can not manipulate the material,
4. We often need a projectionist,
5. Advanced preparation is necessary,
6. Expensive.

A slide is a visual aid. It should complement our presentation and telegraph our message.

Slides should be

1. Legible (to those in the back rows)
2. Simple and
3. Correct

After the Slide is ready

a) We should be able to read the slide unaided at a distance of 8”
b) We should place a ‘dot’ on the left corner of the slide.

[IV] Handouts

In many western universities, the craze is to distribute voluminous, Xeroxed handouts. Photocopying has increased the versatility of handouts ***(8.Dutt et al,*** 1983).

[V] Role of Media / Computers in Teaching

Media consists of tools and technology that facilitate the teaching – learning process.

Computer systems have made important contributions in the field of education and continue to play an increasingly significant role in teaching. Computers have been used to help in learning situation such as practice session, tutorials, games and simulation exercises ***(9.Agarwal, 1983).***

Education through computers has come to be known as **Computer Assisted Instruction (CAI) or Computer Assisted Learning (CAL).**

CAL has become an integral part of our personal and professional lives. It is defined as using the computer technology to assist, augment, or to deliver part or all of the Instruction or course and also to evaluate the student’s progress***. (10.Tejinder Singh et al , 2013)***

Advantages of CAL

1. Basically the classical method of teaching namely the ‘lecture’ is a passive method of teaching . Usually the teacher talks and students listen. There may be some discussion. There is practically no participation by the students. During CAL session, the student is constantly interacting with the teaching material.

2. Second advantage is 'adaptive teaching'. If several different presentations are available in the computerized from of teaching, the student himself can discover the method which is most suited to his attitude to learning.
3. Third advantage of CAL is that teacher can create many experiences, put them in a computerized form and make them available to students.
4. Another aspect of CAL is that learning through a computer is itself a learning experience.

PowerPoint slide presentation with the help of a computer and LCD projector have now almost replaced the other methods of teaching , including Slide projector , O.H.P. and the Chalks & Blackboard.

Two other methods of CAL are learning through Multimedia and the Internet .

Multimedia simply means software comprising of a variety of media together. This can be text, sound and / or videos that can be easily stored and carried in CD format.

Learning through **Internet** is tricky . It is a valuable educational tool, especially when used in conjunction with other teaching techniques ***. (11.Tejinder et al , 2009).***

[VI] Self Learning Exercises: Self instruction performances or independent learning system mean that a student is given independence, responsibility and freedom while he learns, with the help of audio tutorial system, tape slide programs, etc ***(12.Sarin, and Nayar, 1983).***

[VII] Small Group Discussion & Tutorials

Teaching in small group is widely acknowledged to be an ideal method of teaching ***(13.Dutt, and Chhina, 1983).*** Small group discussion and tutorials are teaching – learning activities in which one teacher interacts with 8-10 students ***(14.Tejinder et al , 2013).***

Tutorial is a teacher centered activity . These are usually conducted after few lectures or a series of lectures and are mainly designed to find out the extent of understanding and learning achieved by the students. **Small group discussion** is considered to be faster active learning by the students.,

Objectives

1. To teach difficult or peripheral issues not dealt with in lecture,
2. To discuss experimental methods or research data,
3. To teach practical skills,
4. To develop analytical thinking

To develop an intimate interpersonal relationship etc

VIII] Seminar

Strictly speaking, a seminar is a small group activity, the size of the group being somewhat intermediate between that of a tutorial group and a classroom lecture. The essential difference between a tutorial and a seminar is that while a tutorial is student centered, a seminar means a short lecture delivered by a student to his classmates. The topic is assigned beforehand. The students who benefit from seminar the most are those who speak. They learn how to search for literature on a subject. The students who listen also get benefit ***(15. Ramanarayan, and Nayak, 1999).***

IX] Field trips

If students are taken on a day's trip to some neighboring institute, it breaks the monotony of routine teaching and also broadens the horizon of students beside, of course, teaching them some medical topics.

[X] Free time

Learning during 'free' time may appear a contradiction of terms. All what it means is time during which a student has greater freedom to do what he really wants than in a structured course.

[XI] Research

Research is more intimately related to teaching than is commonly realized. Research forms a component of most postgraduate courses and it has yet to find its due place in undergraduate education. Firstly, the teachers who teach undergraduates should spend part to their time on research. This would keep their minds sharp, open and free from dogmatism and arrogance. Secondly, undergraduates, particularly some selected ones, should have an opportunity for engaging themselves in research.

Research has been variously defined. **Experimental research** is only one type of research. Any activity that leads of disciplined gratification of scientific curiosity is research. A comprehensive definition of research is diligent examination in seeking facts, keen observation with argue to explore and to know the truth and discovery of new facts with carefully devised experiments. According to **Sir Ralph Smith**, "In the association of teaching with research lies the essential difference between education and training."

Thus it is obvious that the classes at college levels must have a research component. A climate of science and temper, generated by research, is the Foundation of Indian renaissance, as visualized by **Nehru**, The **World Medical Education Conference** at **London**, in 1953, recommended that undergraduate medical education shall be imparted in an atmosphere of research. This applied naturally, to all branches of learning. The youngers are inspired by elders whom they would wish to emulated. That is why an atmosphere of research helps catch talented young students . Where there is an inquiring mind, there is potential for discovery. Coming to brass tacks, here is some concrete example**.** At Pondicherry ***, (16) Prof. S.K. Lal et al, 1983*** in classes on simple experiments like determination of hemoglobin or erythrocyte count asked the students at the end to practical class have to come to the board and write their observations .

The results were tabulated and statistically analyzed. This is training in research. A similar approach is adopted at the **All India Institute of Medical Sciences, New Delhi**., while conducting experiments on measurement of blood pressure, effect of exercise of exposure to cold or hot environment, pulmonary functions tests etc. By a suitable modification of the format of our teaching, it may even be possible to get local norms established by undergraduates by doing such experiments on large numbers.

Apart from giving the research orientation to ordinary practical and providing an atmosphere of research for undergraduates , anybody can be involved in real research as well. All India Institute of Medical Sciences offers fellowships to its undergraduates for participating in any research project in any department of their choice during summer vocation. Associations formed during the summer often continue beyond it and so does the research work. **Indian Council of Medical Research** , **New Delhi** also offers fellowships to undergraduates for working on research projects during vocations. If we provide an atmosphere of research in our institutions of higher learning, familiarize our undergraduates with what is going on, and provide them opportunities for doing some of it themselves, we can hope to catch them early enough and shall continue having a band of dedicated research workers to advance the frontiers of knowledge.

[XII] Programmed Texts

The situation created by increasing number of students in medical colleges and relatively few teachers have provided the impetus to seek effective alternatives of supplements to the traditional class room lectures and classical text books. Programmed text books specially necessary because of these factors. Lack of good teachers is felt by all institutions.

[XV] Integrated Teaching

Integrated teaching is an important strategy to promote meaningful learning and make it last for a longer time***. (17.Tejinder et al , 2009***). In addition , integration helps to efficiently recall knowledge when it is required. For all subjects, integration ensures continuity of learning and avoids duplication and redundancy.

Teaching with integration with different departments is very useful for the students. One topic (disease) is decided and students learn Anatomy Physiology, Biochemical aspects, Pathological changes, Community problems, drugs (Pharmacology), treatment (Medicine,Surgery), prognosis and prevention with help of teachers from different departments at one time and the teachers also get benefitted and get the knowledge of different aspects of same topic by their colleagues from other departments. It can be started in the form of symposium with the cooperation of different departments.

[XVI] Community based learning Student may have a trip to different communities, villages along with their teacher. Different families are allotted to students who study about the medical problem of members of those families . Also students come in closer to community and may feel different types of problems of the community by their studies.

[XVII] Extracurricular Activities

Quiz programs, debate competition, art competition (making charts on medical topics) etc. also help in learning of students. Sports facilities, cultural programs etc. help the students to get recreation and make the mind of student more fresh and sharp for their studies ***(18. Bhinde, 1962).***

[XVIII] Distance / Correspondence Education

The purpose of distance teaching is to provide an immediate feedback to the student and guide him towards better learning.

Distance teaching is done by writing academically useful comments , pointing out mistakes and suggesting ways to improve learning. ***(19.Tejinder Singh et al , 2013)***

[XIX] Problem Based Learning

Problem Based Learning (PBL) is a totally different educational strategy ***(20.Tejinder Singh et al, 2013)***

Comparison of students learning in traditional education with problem based tutorial learning

Traditional Learning	
Schedule prepared - fairly tight	*Students largely responsible for own schedule, individually or in group*
Competition with peers for "honors"	*Encouragement to work cooperatively, sharing experience resources*
Main learning events, lecture labs recommended reading with most of students doing same thing	*Wide range of learning resources and events*
Manageable "chunks" of information small enough to be mastered for an examination	*Endless amount of information, with emphasis not on management of information per se but on the management of information appropriate to each individual and its application to problems*
Evalution at the end of course examination limited to defined "knowledge", objectives determined by professor	*Ongoing assessment to board range of goods (including both personal and program objectives) with students as main evaluation of own progress*
Classroom environment, with large groups of students	*Few "class wide" events; close associations with small group of classmate in tutorials*
Predominantly lecture, based role for faculty	*Several faculty education roles, "resources person" and the student advisor roles*

[XX] Microteaching

Microteaching means delivering a small content area to a small group of observers, focusing on small number of skills and then getting feedback on how to improve these. In effect, it means breaking the teaching skills into sub-skills and then trying to improve them individually ***(21.Tejinder Singh et al , 2013)***

[B] Assessment and Evaluation System

Though our traditional examination tests only a narrow range of skills . The gravest deficiency in our evaluation system lies in the complete lack of agreement between examiners on what constitutes a good or a mediocre paper (John Kurrien in 'The Times of India'). Assessment forms the nucleus of our educational system.

The student wants to be taught from the examination point of view and the teachers are often willing to oblige; in the competition for admission and employment, great emphasis is placed on performance in the examination. The equality of examination therefore, has repercussions on the entire educational frame of work.

Internal Assessment

MCI regulations specify that internal assessment shall be based on day to day assessment , evaluation of student assignment ,preparation for seminar , clinical case presentation, etc. ***(22. Tejinder Singh et al , 2012) .***

[I] Assessment of theoretical teaching

There are many ways of teaching knowledge available to the teacher. The criteria to guide the choice of the instrument, and uses are

1. Reliability
2. Validity
3. Feasibility and
4. Effect on students

A student's achievement can be expressed in two ways

1. **Criterion – referred assessment –** This assessment is in reference how well a student does in relation to some pre-determined criteria.
2. **Norm – referred assessment –** This assessment is based on the performance of some reference group, usually the class taking the examination.

There are three major varieties of assessment depending on their purpose and time in relation to course :

1. **Diagnostic assessment –** Its purpose is to find out the suitability for a course or a job, to determine the proficiency of a class at the beginning of a course.

2. **Formative assessment -** Its purpose is to provide the feedback to students and teacher. Its results may form a part of the internal (continuous) assessment.

3. **Summative assessment –** This is final or end assessment at the end of unit, term or course. Its purpose is to rank – order students, and award mark grades or certificates.

Instruments of assessment are :-

[I] Essay Type Questions :

Essay type questions are one of the most commonly used formats for assessing knowledge. ***(23.Tejinder Singh et al , 2012).*** These questions are worded in such a way that the student has the freedom , within the subject context , to determine the nature and scope of the answer.

Essay type questions can be conveniently classified in two types

1. **Extended response essay questions:** Provide freedom to the pupil to respond over a wide range. This type is very difficult to evaluate and has a dubious role in evaluation.
2. **Restricted response essay questions:** tend to limit both the content and the form of the pupil's response. This type of essay questions is recommended for student's evaluation.

Advantage of Essay Questions

1. Provide a measure of complex leaning outcomes which cannot be measured by other means.
2. Have desirable influence on student's habits. Pupils tend to direct their attention towards integration and application.
3. Essay of construction.

Disadvantage of Essay Questions

1. Unreliability of scoring,
2. Amount time required for scoring,
3. Limited sampling of the subject
4. Questions encourage the student to bluff and
5. Do not provide adequate feedback on the quality of teaching.

In **Modified Essay Question** a problem or case scenario is presented to the student and a context is set ***(24.Tejinder Singh et al , 2012). .***

[II] Short Answered Questions :

They are an important step forwards compared to essay type of questions. The expected answers are short and sequential, rather than discursive.They are good at assessing specific content areas.

Merits of SAQ

1. Far more reliable.
2. Appropriate structuring allows asking exactly what the examiner expects the student to know. Validity is also high.
3. Proficiency in language does not play an important role.
4. Permit the assessment of coherence of an argument and correct sequencing of facts in the developing of the argument.
5. The bits of knowledge are retrievable form of the memory stored outside of the situation of recognition.
6. No possibility of change success. Student has no strong temptation to guess.

Demerits of SAQ

1. Take considerable time and effort to frame
2. Correction is not very quick either. But the effort is worth the benefits raped.

[III] Objective tests :

Belong to the following categories

a) Competition Items: more commonly called "fill in the blank" type of questions

b) True or False type questions

c) Multiple choice questions: In these questions the student is expected to 'choose one answer 'from a list of possible answers. ***(25.Tejinder Singh et al , 2012).***

‘ Item ‘ is used more or less synonymously with the ‘questions.’ the ‘stem’ is the statement which precedes the four or five suggested answers or competition which is following it. The term ‘distracters’ is used for all the suggested answers in an MCQ except the correct one.

There can be framed different type of MCQs

1. Single response correct type,
2. Multiple responses correct type,
3. Matching type,
4. Comparison type and
5. Programmed text.

Merits of MCQs

1. Reliability is extremely high,
2. High validity. A large area of syllabus can be sampled,
3. Results are not affected much by proficiency in language,
4. Provide detailed feedback for both students and teachers
5. Very easy to correct and
6. Particularly suitable when the group tested is very large

Demerits of MCQs

1. Require a lot of time to construct,
2. Encourage student to guess,
3. MCQ format provides substantial clues,
4. Expensive to arrange and
5. In spite of all precautions, the questions may be ambiguous, or its answer controversial.

[II] Assessment by Oral Examination

Oral examination (viva- voce) is a face to face interview between examiner and the examinee. It refers to a format of assessment that calls on students to use the spoken word to express their knowledge and understanding ***(26. Tejinder Singh et al , 2012).***

Oral tests can be used for assessing the student both in theory and practical. **In theory** oral exam is conducted by few teachers simultaneously. **In practical** the teacher interviews the candidate at the end of every practical. For oral examination, the examination should be preparing a long list of questions sorted out in term of difficulty. A convenient way to do so is to take **three cards (card system of viva-voce).** One card may be used to jot down easy questions, the second for questions of intermediate difficulty level, and the last for the most difficult ones. The candidate’s score should depend upon whether the candidate answers all the questions asked, and to what difficulty level he can be taken. Even with this method the element of subjectivity remains but its severity gets minimized.

[III] Assessment by Practical Examination

One of the most important aspects of training of a doctor is acquisition of practical skills. ***(27.Tejinder Singh et al, 2013).***

During the practical examination, the students spend three hours during an experiment. The examiner spends three minutes assessing him, and this brief encounter usualiy degenerates into a theoretical discussion. In such an experiment, the evaluation of the candidate becomes merely a matter of chance. That is why 'spots are introduced as a component of the practical examination. Spots introduce considerable objectivity into the practical examination.

Objectives of practical examination

At the end of practical course, the student should be able to

1. Demonstrate certain practical skills,
2. Make correct observation,
3. Analyze and interpret data,
4. Demonstrate the spirit of enquiry,
5. Explain logically unexpected observations and,
6. Detected and correct minor faults in the equipment

These are the basics of different tools to improve medical education. A lot of modification can be done in this regards.

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