

Science Education Through Distance Learning System

By

Dr. Allah Rakha Saghir*

I Introduction

As we all know, distance education approach has emerged as a response to the diversified growing educational and training needs of the tremendously increasing population in the world in general and in the developing countries in particular. The ever-growing pressure of increasing number of children on traditional educational institutions and limited resources led the educationists to explore non-conventional alternative strategies to meet the new challenges which led to the adoption of distance education system. Pakistan, with an estimated population of about 114 million, inevitably needs this system of education to meet the growing educational needs of people. The establishment of Allama Iqbal Open University in 1974 was really in response to this genuine needs.

Distance education emerged not only in response to the pressure of increasing number of people, but also because new and more relevant academic programmes were urgently needed to respond more sensitively to ever-changing socio-cultural needs, especially those emerging out of the trends towards industrialization and urbanization which are quite evident in most of the developing countries of the world today.

Some other advantages include (I) the relative low cost, if the number of students is adequate and the courses are planned and executed on long-term bases, and (ii) the opportunity it offers for individualized learning which is generally missing from the formal system of education. There is, however, a word of caution! These advantages of distance education have to be interpreted with extreme care because a very strong element of teacher, which is instrumental in motivating the learners is not there in its traditional form in distance education system.

*The writer is working as Director/Associate Professor in Allama Iqbal Open University.

It is now an established fact that with the passage of time, the interest of different countries, especially the developing ones, has tremendously increased in distance education. Supplemented by media and tutorial support, the distance education approach has successfully overcome some of the initial formidable problems and emerged almost as effective as the face-to-face traditional system in imparting education in non-science course/s. It is, however, generally felt that this system does not seem to meet all the conditions required for teaching pure sciences i.e. natural sciences. This mis-conception is based on the hard fact relating to the physical distance between the teacher and the learner, and for that reason they cannot have an immediate face-to-face contact as against in the formal system of education. But, at the time in the modern world of tough competition in technological advancement, we cannot afford to relegate the position of teaching science simply because of the limitations imposed by the time and space factors in distance education. The situation, therefore, does necessitate for exploring still newer and more innovative ways and means for teaching science to compete in the modern day world. But, before we deliberate upon the same, it seems quite pertinent to hint at some very basic things about science which would help us in understanding the phenomenon and equipping ourselves in a better way and handling the problems associated with science education through distance education institutions more effectively.

II. Nature of Science

It has rightly been pointed out that science is both a body of knowledge about our environment and a method of inquiry. It has enabled mankind to understand, predict and in some cases even control, to a great extent, the happening of such events which were hitherto considered as something falling in a world simply out of the reach of mankind. Hence, as a result of our continuous inquiry into the phenomena, new sets of facts, bodies of knowledge and syllabi are emerging to meet the rapidly changing needs of the modern day world.

Consequently, the recent past has witnessed an increasing need and significance of the off-and-on revision of science curricula and the development of instructional methods and techniques compatible with the nature and contents of science. As a result of that, we find increasing emphasis on practical work, discovery process, individualizing instruction etc. etc. in teaching and corresponding changes in teacher education programmes in the field of science. This is, however, true about science education in formal educational institutions.

On the other hand, due to the absence of lab facilities for science teaching, the distance teaching institutions have generally been reluctant and hence quite slow in designing and offering science course/s at different levels. That is why the AIOU in the past, has been relatively slow in this very important area. But it is quite encouraging to note that the barrier is gradually breaking down because of a number of innovations at the AIOU

III. Major Aspects of Science Education through Distance Learning System

A number of major pedagogical aspects relevant to science education, inter-alia include the following:

1) *Correspondence Material*

The correspondence material forms a major part of the total learning package used in distance education. It may take any form, for example, as the following:

- i) Study material in the form of self instructional material, study guide, etc.
- ii) Allied material to be studied in addition to the main study material, etc.
- iii) Work-book for doing exercises and under-taking other relevant activities leading to independent learning.
- iv) Assignments along with instructions and schedule of submitting the same to the tutor.
- v) Schedule of radio and/or TV programmes, if any.
- vi) Practicals book for recording details of practicals conducted at the study center/model study center or at home.
- vii) Any other additional material.

Study material in science education through distance learning system may be developed by subject specialists well versed in distance teaching techniques.

Numerous types of activities may also be given in the text at appropriate places. Depending upon the nature of the topic, learning activities may pertain to observation, collection, classification, analysis, interpretations, questioning and requisitioning about different aspects of the phenomena under discussion. As such, the AIOU will have to make drastic changes in its study package for students to make science education more effective through its distance education system.

These study materials, in addition to having theoretical description, illustrations about conducting experiments and other relevant learning activities, may also have glossary of scientific terms which the learner is likely to come across during the study. This would help the learner in internalizing concepts. In the realm of science, especially for students enrolled in distance education institutions, such terms must form an essential part of the study material.

2. *Strengthening of Study Centers*

Study Centers provide an important forum for facilitating the face-to-face contact of the teacher (in the form of a tutor) and the learners and among the learners themselves as well. The AIOU is currently having one thousand study centres throughout the country. Effective science education through distance system requires the strengthening of the study centers/ model study centers with a wide variety of non-broadcast media and other relevant equipments such as the following:

- i) Video films of practicals conducted under the guidance of experienced teachers.
- ii) Multiple sets of charts explaining different concepts.
- iii) Flip charts prepared on different steps involved in conducting practicals about which instructions for the tutors and students should be recorded in the accompanying audio cassette/s.
- iv) Audio-cassettes, preferably containing lectures/demonstration sessions by renowned teachers of the subject.
- v) T.V. Monitor for playing video films.
- vi) Tape-recorders for playing audio-cassettes.

- vii) Radio for listening to lessons broadcasting, if there is any, and also general education talks delivered by eminent educationists and experts in different fields related to science.
- viii) Working models explaining functioning of different machines e.g. steam engine, hydraulic press, etc. etc.
- ix) Solid models of different things.
- x) Any other relevant item.

The entire equipment at the Study Center may be used by the students under the guidance of the tutor who does need an intensive training in instructional as well as in inter-personal skills to promote learning in distance education system.

3. *Tutorial Services*

In science education through distance learning system, tutor is the most crucial input. Arrangements, therefore, need to be made for an adequate training of tutors in all relevant aspects at different stages of launching science courses. At the pre-launching stage, training workshops may be held for imparting training to them in a number of aspects including techniques of evaluation, giving feedback, guiding the students in conducting practicals, etc. etc. Accordingly, the training package would contain:

- i. material on general orientation in the philosophy of distance education system and general methods of instruction with reference to the problems emanating from distance education system.
- ii. subject-specific training with reference to the methods of instruction in science and the learners' problems emanating from the very nature of the subject.

Furthermore, the training of tutors may not be taken just as a one-shot activity. Rather there is a dire need to combat the problem on continuous bases with the help of a *Mobile Training Squad* (MTS) duly equipped with mobile labs. This pre-supposes the training of members of the MTSs in techniques of imparting training to the tutors. It is desirable to include in this team (i) Senior Tutor (or whatever his nomenclature) i.e. a person having rich experience as a tutor in sci-

ence/s, (ii) distance education specialist, and (iii) an expert in the use of teaching aids, etc. etc.

Training Manual may be prepared for the tutors containing general as well as specific instructions for use as and when needed. This needs to be revised and up-dated along with each revision of the curricula.

4. *Science Kit and its Use in Practicals*

Science kit and its possible use in practical work does deserve a special mention. It must form an essential part of the correspondence package supplied by the distance education institution. The Science Kit serves as a set of tools in the hands of science student which helps him in exploring the phenomena around, collecting data, classifying and interpreting the same and drawing inferences, etc. etc. The kit, as supplied by the institution, must contain in it the most essential items required for performing practicals on the most crucial concepts to achieve the course objectives. These may, for example, include items like hand lenses, magnetic needle, prism, etc. In addition to that, should also include extremely essential chemicals relating to the maximum concepts through practicals. The learner also needs to be encouraged to make use of improvised chemicals and apparatus. He may, for example, use lemon juice or even indigenous drink "LASSI" for citric acid, tin for container, etc. etc. Similarly, locally available material like torch cells, bulbs, thermometer, common pins, wires, plants, flowers, etc. and many others may also be used by the student to perform practicals. This, however, requires a continuous monitoring by the tutor or the nucleus staff in a number of ways.

The kit must contain a list of common names of some of the chemicals required in practicals. For example, we can motivate the student by telling him that by sodium bicarbonate we mean baking soda, by sodium carbonate we mean soda ash, by sodium hydroxide we mean caustic soda and so much so that by sodium chloride we mean the common salt. The knowledge of student regarding the chemical as well as common names of these items found around would go a long way in motivating him to undertake frequent practicals by using them and internalize the processes involved.

The science kit must have a detailed set of instructions for the student and clearly indicate the hazards which must be avoided while using the kits.

5. *Media Support*

In addition to the non-broadcast media, there is a tremendous scope for the utilization of appropriate electronic and other types of media to supplement the printed study material supplied to the students. The more the importance of media in promoting science education through distance techniques, the more difficult and complex process is it to decide about the same. For this purpose, numerous factors will have to be taken into consideration. They may, inter alia, include the nature and objectives of the course/s, learners' number and profile, availability of supportive material, etc.

Usefulness of radio and TV programmes in promoting science education through distance learning system already stands well established. Introduction of internet just few years back and its wide-scale adoption in 1997, is still another technology which is being used quite increasingly by distance education institutions around the world. But all the more, there is a greater scope for the use of techniques facilitating two-way communication among the teacher and the students and even among the students themselves. Teleconferencing may be used for instant link among the science tutor and several individual learners engaged in their learning activities at separate places. It can bring the individual learners together and emerge as a group method of teaching and learning science at a distance. The ancillary media like audiographics can be adopted to send graphs, images, etc. to distant viewers. Still there is a long list of electronic gadgets that can be successfully utilized in promoting the teaching of science through distance education.

Video teleconferencing can go a long way in totally removing physical distances which can prove to be very helpful in promoting the cause of science education. In some cases, distance learners have been known to have attempted to shake hands through the screen at the conclusion of a meeting, having momentarily forgotten that the person they have been talking with is really thousands of miles away. But, before we can go for using such sophisticated techniques, we will have to take into account a number of complex factors including the costs involved, suitability of the media and other relevant aspects.

6. *Evaluation*

While the pattern of evaluation of science students, by and large, would fall within the overall framework of distance education, nature of the science course/s does necessitate minor adjustments in the same. In distance education, there has been found a general tendency among the students to accord low priority to practi-

cal work which actually makes the corner-stone of science education whether taught in formal or in distance education institutions. In distance education system, importance of practical work becomes rather all the more greater. Hence, such an attitude on the part of students needs to be completely reversed. For that purpose, a mechanism will have to be evolved to give adequate weightage to the number of practicals performed by the students independently or under the guidance of the tutor who must certify the same on the note-book of practicals for the course/s. This weightage may form a part of the internal evaluation which mainly consists of the assignment component preceding the final written examination towards the end of the semester.

IV. Some Issues

Some of the issues pertaining to the promotion of science education through distance way of learning may be briefly spelled out as under:

- i. Balance between theory and practical components of the course/s.
- ii. Emphasis on local situation versus national level phenomena.
- iii. Individualizing instruction.
- iv. Replenishment of Science Kit, etc. etc.
- v. Collaboration between public and private sector NGOs engaged in similar activities.
- vi. Involvement of sectors like industries, agriculture health, etc.
- vii. Bases of collaboration with formal education institutions.
- viii. Any other.

V. Interinstitutional Collaboration

Towards the end, a few words seem to be quite pertinent about the inter-institutional collaboration in promoting the cause of science education through distance techniques. With the passage of time, the whole world has shrunk and become global village due to unprecedented developments in communication technology. This offers a tremendous scope for still closer collaboration among dis-

tance education institutions of the world in general and those located in this region in particular in devising the ways and means for promoting the teaching of science. This may entail:

- i. the holding of joint meetings of experts in the field,
- ii. exchange of academic as well as other relevant staff engaged in science education activities,
- iii. exchange of materials and technology, etc. etc.

Holding of such activities as the above ones would help in mutual sharing of ideas, experiences and exchange of materials and technology in the field.

It would not be out of place to mention here some of the innovative steps taken by some distance education institutions of the Asian region the technology about which may be shared by others.

- i) The Indira Gandhi National Open University, (IGNOU) has already started using central facility with a conference room at headquarters and reception arrangements at regional centers and some selected study centers spread all over India for one-way video and two-way audio communication. The technology could be used to promote the teaching of science quite effectively.
- ii) The Ambedkar Open University makes use of the labs facilities of colleges (both in public as well as private sector). Students who miss the practicals are provided a second chance by mobile lab facilities. As per the announced programme, the van stops at notified car parks each for four hours.
- iii) The Sri Lanka Open University provides mobile lab facilities at regional centers for five days each where the students perform experiments mainly pertaining to situation prevailing in the environment.
- iv) The Allama Iqbal Open University (AIOU) though has already started offering science courses at Intermediate and primary teachers training levels, yet teaching of basic sciences stands out as one of its weak areas. While it is planning to offer some more courses

in basic sciences, it may capitalize upon the experiences of other universities engaged in teaching basic sciences at different levels.

The tremendous amount of communication technology that exists today awaits imaginative and adventurous educators, media specialists and others to come forward and design an effective and accessible system supportive for the teaching of science within the overall system of distance education. There is, however, lot of scope for further research and thread-bare analysis of the topic under discussion and promote the cause of science education through distance education techniques.

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