

SCIENCE EDUCATION THROUGH OPEN AND DISTANCE LEARNING AT HIGHER EDUCATION LEVEL

Dr. Amrita NIGAM
School of Science,
Indira Gandhi National Open University
INDIA

Dr. Vibha JOSHI
School of Education
Indira Gandhi National Open University, INDIA

ABSTRACT

The changes faced by the society in the past few decades brought revolution in all areas. The job requirements have undergone change tremendously. The emergence of e-culture, e-education, e-governance, e-training, e-work sites and so on questioned the capacity of conventional face to face education in catering to all and relevance of existing job related skills to a great extent in the emerging global society. Today, every one has to update his/her educational and/or professional skills and competencies to cope up with the emerging work challenges. This is more so in the field of science and technology. At the same time, it is impossible to cater to educational and training opportunities to one and all those who aspire for it through the conventional set up. The distance and open learning (ODL) seems to be one of the viable alternatives. Today, the success and viability of ODL is accepted globally. Coulter (1989), through a study demonstrated that ODL is a cost-effective medium in providing educational opportunities. Similarly Holmberg (1981) also mentioned ODL as a systematic teaching-learning medium by using variety of medium for imparting learning.

The present study is an attempt to study the experiences of the open science learners of IGNOU on different aspect of the science higher education. Here a questionnaire was used to collect the data and responses from 81 students enrolled for B. Sc. from IGNOU were collected. The findings of the study reported that society has undergone drastic changes in the last few decades.

The revolution led due to Information and Communication Technologies (ICTs) have widely affected all aspects of society. The emerging jobs require entirely new skills and competencies i.e., employment in BPOs or switching over to e-governance, e-Banking and e- based sectors.

Even e-learning has made numerous expectations from teachers and other personnel. The use of ICTs in almost every field needs adequately trained workers so that they can work efficiently and effectively. The training and retraining avenues in the conventional system is grossly inadequate to cope up with the present and future demands. In this situation open and distance education is the available alternative.

Keywords: BSc degree; intensive practical work; Women students; distance teaching-learning methodology; Academic Counselling; communication technologies

INTRODUCTION

Open and distance education is now being accepted world widely as an alternative teaching-learning and training medium. It was quite popular in teaching courses in Humanities and Social Sciences at the higher education in the country since 1962. The emergence of distance education and use of multi and multiple media for transaction made this mode effective in delivering courses in disciplines which needed intensive practical and face to face situations. In spite of the potentialities of the media and self-learning nature of the instructional/training modules, many obstacles have been encountered in teaching practical based courses like courses in Science and Technology, Agriculture, Nursing and Medicine and so on.

Another important feature is the heterogeneity of learners in ODL system. For some it is a chance to get tertiary education, for some to de-tag the label of drop-outs or unskilled or semi-skilled workers.

Now a days, distance education and open learning system is one of the most feasible and viable alternative teaching-learning and training medium that has broadened areas of education to all those who by one or the other reasons are not able to availed it.

It has been found equally beneficial for the disadvantaged groups such as people living in rural and remote areas, women, socially, geographically and economically under-privileged groups. Additionally, it has proved to be cost effective in improving educational opportunities (Coulter, 1989). It has also been demonstrated that teaching science and technology courses can be taught effectively through the distance teaching-learning mode. The proliferation of information and communication technologies (ICTs) has strengthened its potentialities further. Consequentially the small sapling of more than four decades old (the 1962 experiment of Delhi University) distance education has attained a seasoned stature of a banyan tree, which is still growing.

Open and Distance Learning (ODL) at the higher education level has much more responsibilities. On one hand, it has to cater to the young school leaver's need for higher education and on the other hand to working people by providing opportunities for their training and re-training requirements in diversified areas and levels. It has also to look into the needs of those require new skills and competencies needed to be fit in the competitive world of education and work.

The open and distance education is different because it uses the pre-produced courses as the basis of study with well-organized two-way communication between students, and a supporting organization with its tutors and counsellors; and planned and explicit catering for individual study (Holmberg, 1981). The purpose of distance education at tertiary level is not only to provide an opportunity for people to complete degrees or diplomas but also imparts an important means of acquiring further knowledge, as a part of continuing education.

The feasibility of offering non-science courses is accepted entity but distance education in sciences/science and technology is still grappling with numerous implementation stages. Some of the common issues/problems faced during course design and development are:

- **Selection of the learning centres**
- **Development of course materials in Self Learning Material Formats**
- **Preparation of practical manuals and home- kits**

- **Monitoring of the learning centres which provide expected learning support to learners in practical**
- **Evolving the feasible learning support to learners in a convenient and nearest learning centre**
- **Heterogeneous learner groups and course.**
- **Cost effectiveness.**

The development of programmes in science and technology areas is a complex and dynamic process with many typical problems as it needs more interactions and cooperation of teachers, learners and institutions.

Number of open learning institutions have increased quantitatively as well as qualitatively and they are offering various types and levels courses in science and technology. There is still need for more courses in science/science and technology and also at different levels.

The teaching of science and technology courses involves intensive practical work, which by open and distance education requires special techniques, learning material and specialized learning centre. Though such aids have been developed, special orientation of administrative and academic staff is required to conduct these programmes successfully.

Through this study efforts have been made to study the common issues and problems faced by distance science learners pursuing Bachelor of Science (B.Sc.) of the Indira Gandhi National Open University.

INDIRA GANDHI NATIONAL OPEN UNIVERSITY (IGNOU)

Indira Gandhi National Open University (IGNOU) was established in September 1985 by an Act of the Parliament to advance and disseminate learning and knowledge by a diversity of means including the use of all possible information and communication technologies (ICTs). In the process it has to increasingly aim at democratization of higher education and maintenance of high standards covering larger segments of population, vocations and professions. Besides, it has to encourage and strengthen the open and distance education systems in the country and even outside the country.

IGNOU provides access to higher education to all those who desire and need to improve their qualifications, skills and competence. The learner is free to study at his/her pace and time his/her studies according to his/her convenience. The important features are:

- **Relaxed entry qualifications for specified groups,**
- **Study according to learner's pace, place and convenience,**
- **Flexibility in selecting courses and**
- **Use of modern and appropriate educational and communication technologies.**

School of Science

The University has been offering various programmes of studies. Presently it has eleven schools of studies and School of Sciences is the principle school in developing programmes in science discipline. The various programmes, Diplomas and Certificates, on offer by the school are:

- **Bachelor of Science (B.Sc.) Botany**
- **Bachelor of Science (B.Sc.) Chemistry**

- **Bachelor of Science (Mathematics)**
- **Bachelor of Science (Physics)**
- **Bachelor of Science (Zoology)**
- **Bachelor of Science (General)**
- **Certificate Programme in Laboratory Technician (CPLT)**
- **Certificate in Teaching Primary Mathematics (CTPM)**
- **Diploma in Aquaculture**
- **Postgraduate Diploma In Intellectual Property Rights (PGDIPR)**
- **Postgraduate Diploma In Environment And Sustainable Development (PGDESD)**
- **Awareness Course On Intellectual Property Rights (AIPR)**
- **Appreciation Course on Environment (ACE)**

The School has developed courses in science at various levels (preparatory, electives and application oriented) for distance learners at different entry levels in two languages i.e., Hindi and English.

The School has also contributed courses for various programmes for the University, namely, Preparatory program for Bachelor degree, Computing and Certificate in Environmental Studies programmes.

Bachelor of Science (B.Sc.)

The School has been involved in launching and implementing the Bachelor's in Science programme (B.Sc). This program was the pioneer programme of the School and also of the University in offering science courses through open and distance mode. The course development pertaining to these courses takes place in respective disciplines.

The first science programme was started in the pilot phase in 1991. The first batch had 1100 students in 29 study centers scattered all over the country.

Today there are about 6000 open science learners pursuing Bachelor in Science through 146 study centers in the country. The open science education programmes for undergraduate level of the University are given below:

- **Bachelor of Science (B.Sc.) Botany**
- **Bachelor of Science (B.Sc.) Chemistry**
- **Bachelor of Science (B.Sc.) (Mathematics)**
- **Bachelor of Science (B.Sc.) (Physics)**
- **Bachelor of Science (B.Sc.) (Zoology)**
- **Bachelor of Science (B.Sc.) (General)**

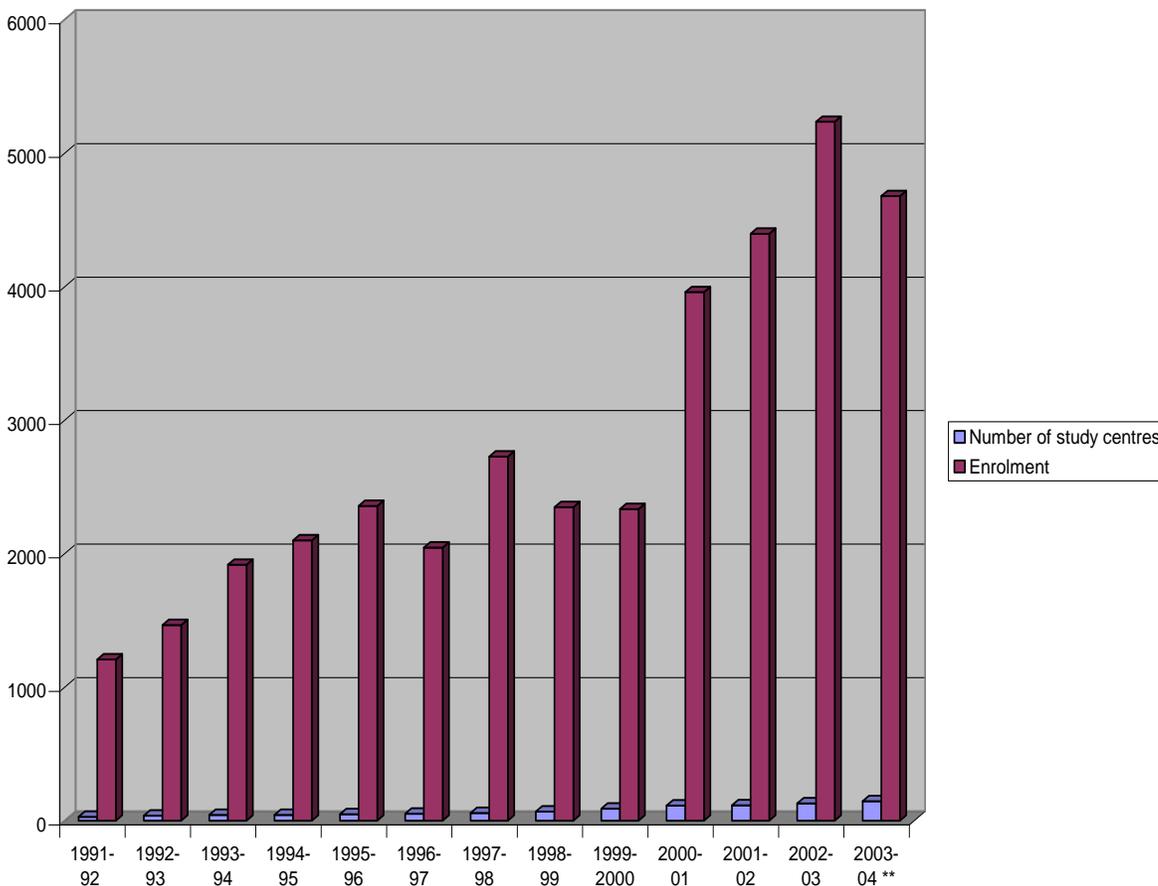
This Bachelor Degree Programme in Science is a three years programme with 96 credits weightage. In the University learning load has been quantified in terms of credits. A credit worth of learning material signifies learning time of 30 hours for an average learner.

It includes all activities pertaining to study one credit worth of learning material i.e., going through the material, doing assignments, viewing telecasts, listening to broadcasts and audio programmes in cassettes, radio and conventional counselling, library consultations, laboratory and other field based practical activities and so on.

Today an open science learner is eligible to opt for Bachelor in Science in four majors i.e., Chemistry, Life Sciences (Botany and Zoology), Physics and Mathematics. The Life Sciences specialization has been bifurcated into two majors i.e., in Botany and Zoology.

Table: 1
Growth and pattern of Study Centers and
Students Enrolment.

| Year | Study Centres activated | Students Enrolment |
|-------------------|--------------------------------|---------------------------|
| 1991-92 | 29 | 1208 |
| 1992-93 | 38 | 1465 |
| 1993-94 | 44 | 1917 |
| 1994-95 | 44 | 2100 |
| 1995-96 | 48 | 2358 |
| 1996-97 | 52 | 2045 |
| 1997-98 | 58 | 2727 |
| 1998-99 | 68 | 2348 |
| 1999-2000 | 90 | 2334 |
| 2000-01 | 114 | 3959 |
| 2001-02 | 116 | 4396 |
| 2002-03 | 130 | 5235 |
| 2003-04 ** | 146 | 4678 |



This programme is also on offer to the Indian work forces working in other countries; therefore It has *International reach- beyond the national boundaries*. The University offers programmes in other countries. At present the University has collaboration

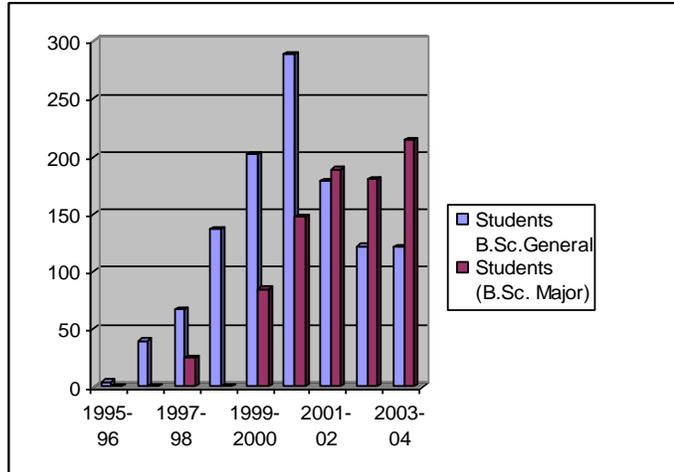
with many countries in the Middle-East region, Africa continent and also in South East regions.

Students successfully completed so far

Open science learners have been awarded degree of Bachelor of Science (B.Sc.). This shows the viability of the open and distance system in teaching courses in science and technology. In other words, courses needs intensive practical work can be delivered successfully through this system. The table 2 presents the number of open science learners successfully completed the programme of study.

Table: 2
Students successfully completed

| Year | Students (B.Sc. General) | Students (B.Sc. Major) |
|---------|--------------------------|------------------------|
| 1995-96 | 4 | 0 |
| 1996-97 | 40 | 0 |
| 1997-98 | 67 | 25 |
| 1998-99 | 137 | 0 |
| 1999-00 | 202 | 85 |
| 2000-01 | 289 | 148 |
| 2001-02 | 179 | 189 |
| 2002-03 | 122 | 180 |
| 2003-04 | 214 | 121 |



The above table and graph show that in 1995-96 four students completed the bachelor in science programme and there is a steady increase in the number of students who have successfully completed over successive years. In 2003-04 about 335 students got the B.Sc. degree through open and distance system.

Relationships with other programmes

The Bachelor’s in Science is a stand alone programme consisting of various courses. The courses developed by the School have been in use by other Schools /programmes of studies.

Special privileges to any sections/groups of students like women, ST/SC, disabled etc.

ST/SCs and disabled students enrolling in these programs are getting the benefits provided by the Government of India and other State Governments, other organizations in promotion of education. Women students enrolled in some states have been given incentives by that state government by exempting their fees.

Present Study

The present paper is the feedback study on the open science learners from IGNOU. It was conducted with the sole objective of collecting feedback from the science learners on various components pertaining to the learning material, learning supported components and implementation/delivery mechanisms of the University in this program.

COLLECTION of DATA

A questionnaire was developed and administered on all science students present for practical at the study centres located in Delhi Region. Questionnaires were also sent to the students by post. Only 81 questionnaires were received. The data was

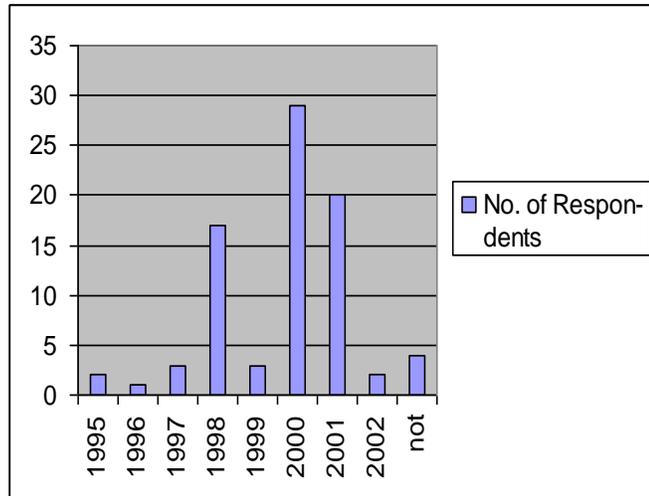
tabulated and presented in the given tables: No rigorous statistical sampling technique was employed but the convenient sampling technique was used for data collection. Analysis in terms of enrollment, gender, age, working status, and distance from residence and work sites, reasons for joining open distance science programme is done in the present paper.

Enrolment wise Distribution

Data is presented in the tabular and graphical forms.

Table: 3
Year of enrolment wise distribution

| S. No. | Year of Enrolment | No. of Respondents |
|--------|-------------------|--------------------|
| 1 | 1995 | 2 |
| 2 | 1996 | 1 |
| 3 | 1997 | 3 |
| 4 | 1998 | 17 |
| 5 | 1999 | 3 |
| 6 | 2000 | 29 |
| 7 | 2001 | 20 |
| 8 | 2002 | 2 |
| 9 | not mentioned | 4 |
| | Total | 81 |



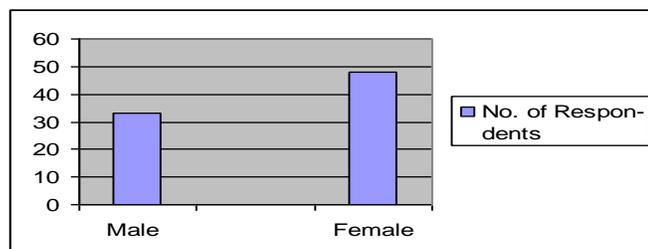
The data presented in the table 3 and graph show that more than half (49/81) of the respondents were from the academic years 2000 and 2001. This may be the time of data collection (2003) and these learners were second or third year students of the university.

Gender wise Distribution

Data is presented in tabular and graphical forms.

Table: 4 Gender wise Distribution

| S. No. | Gender | No. of Respondent |
|--------|--------|-------------------|
| | Male | 32 |
| | Female | 49 |

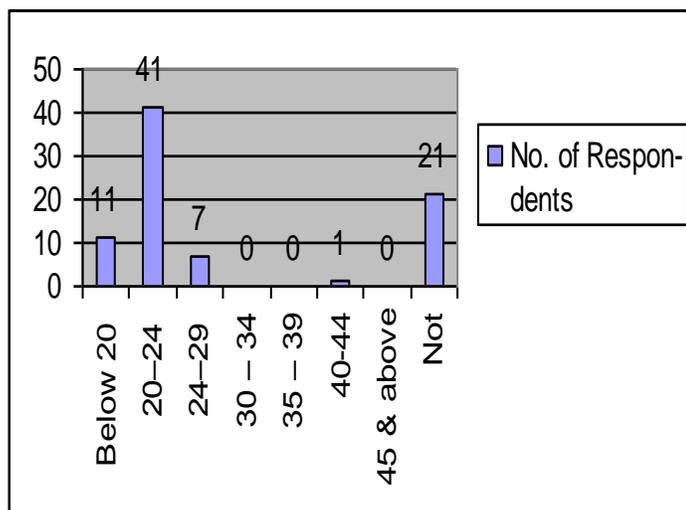


| | | |
|----|--------|----|
| 1. | Male | 33 |
| 2. | Female | 48 |
| | Total | 81 |

The table 4 shows that about 60% of the respondents were female and 40% male learners. This observation supports the feasibility of acquiring higher education through open and distance mode for women learners. In other words this system enables women learners to acquire higher education in science too. Age-group wise distribution. The table 5 and adjacent graph present the age-wise distribution of the respondents.

Table: 5 Age-group wise distribution

| S. No | Age-group | No Respo |
|-------|---------------|----------|
| 1 | Below 20 | 11 |
| 2 | 20–24 | 41 |
| 3 | 24–29 | 7 |
| 4 | 30 – 34 | 0 |
| 5 | 35 – 39 | 0 |
| 6 | 40-44 | 1 |
| 7 | 45 & above | 0 |
| 8 | Not Responded | 21 |
| | Total | 81 |



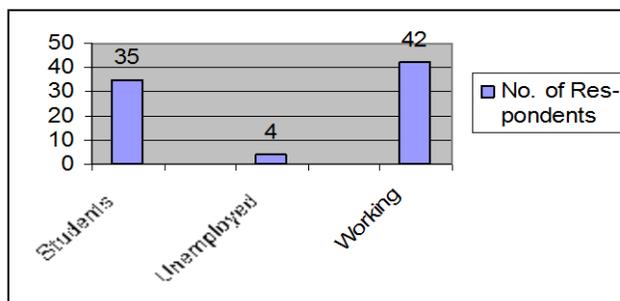
Data given in the table 5 shows that two-third of the respondents were up to the age of 24 while one-fourth has not mentioned their age-group. This observation may also strengthen the aspirations of the youth population to go for science higher education even though either denied access at the conventional higher education science institutions or working ones.

Designation/working status wise distribution

Table 6 and corresponding graph show the distribution of respondents on their designation/ working status.

Table 6: Designation/working status

| S. No. | Status | Res |
|--------|------------|-----|
| 1 | Students | 35 |
| 2 | Unemployed | 4 |
| 3 | Working | 42 |
| | Total | 81 |



The data presented in the table 6 shows that more than half of the open learners were working and more than 40% were doing open science education as full time conventional students. This may reflect the importance of open science education courses at the higher education level.

Place of working and residence wise distribution

Table: 7 and corresponding graph present the distribution of the respondents according to their place of working and residence.

Table 7:
Place of working and residence wise distribution

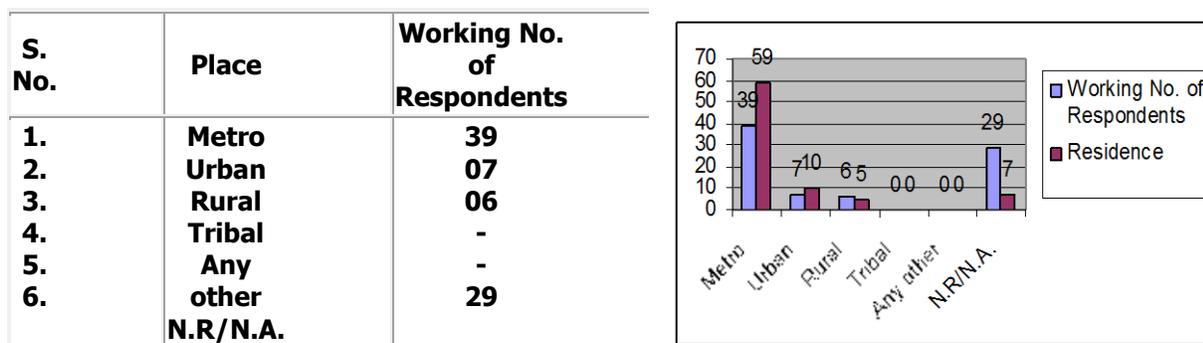


Table: 7 shows that nearing 50% of the respondents were working and three-fourth residing in the metropolitan cities. Not even one tenth of the respondents were from rural areas and no one from tribal areas. About one-third of the respondents have not responded. This may be due to the sampling procedure adopted in this study and also implies that more efforts are needed to reach learners from remote, rural and disadvantaged places.

Table: 8:
Source wise distribution of Respondents

| S. No. | Options | IGNOU | B.Sc. Programme |
|--------|--|-----------|-----------------|
| 1. | News Paper/ TV/ web site | 25 | 10 |
| 2. | Visiting IGNOU/ Regional Centre | - | 7 |
| 3. | Through Prospectus/ Programme Guide | 1 | 14 |
| 4. | Teacher/Father/IGNOU faculty | 4 | 18 |
| 5. | Friends/Relatives/Colleagues | 29 | 24 |
| 6. | Ex-student of IGNOU Sc. Background, interested in doing B.Sc. Correspondence | 2 | 2 |
| 7. | Well known University Total | - | 3 |
| 8. | Others | 1 | 1 |
| 9. | Not mentioned | - | 2 |
| | Total | 62 | 81 |

Source wise distribution

Table: 8 shows the distribution of the responses according to the common sources from that respondents came to know about the university and its programme.

The Table: 8 shows that friends/relatives and newspaper/TV/web site are the popular sources of publicity of IGNOU's and Science programmes. Even admission prospectus of the University is a major source to get complete details of the programme. This observation may suggest that newspaper, website, television, friends and relatives could be used judiciously to popularize programmes of the University.

Reasons for joining B.Sc. Programme

Reasons cited by the respondents for joining this programme are given in the table: 9.

Table: 9
Reasons for joining B.Sc. Programme wise distribution

| S. No. | Reasons | No. of Respondents |
|--------|---|--------------------|
| 1. | Wants to do a Bachelor in Science | 21 |
| 2 | To get a permanent and good job opportunity in a MNC | 1 |
| 3 | Earn while learning / in job & study simultaneously & easily | 11 |
| 4. | For getting higher education/graduation | 7 |
| 5. | Late for regular courses in DU | 3 |
| 6 | Diploma in Pharmacy thus interested in Science Course. | 3 |
| 7. | Simultaneously pursuing two courses | 3 |
| 8. | Courses Related to the profession | 5 |
| 9. | Part-time/ and through correspondence | 12 |
| 10. | Having one professional course. And need graduation in science to uplift the career | 2 |
| 11. | Only IGNOU offers B.Sc. through distance mode | 2 |
| 12. | To improve the knowledge | 3 |
| 13. | For promotion in job | 2 |
| 14. | Easy to complete programme | 1 |
| 15. | Do not want to join regular college | 3 |
| 16. | IGNOU is recognized by India & abroad. | 1 |
| 17. | Doing some script writing of telefilms and serials | 1 |

The table 9 shows that for the majority of the respondents pursuing Bachelor's in Science (B.Sc.) were the main reason. Earn while learn, part time or having higher

education through distance mode and are the other reasons. Some of them joined as it was directly related to their job or its promotion.

Location of Study Centre and Residence

Data with respect to location of study centre and their residence is tabulated and presented in table 10.

Table: 10
Location of Study Centre and Residence Wise Distribution

| S. No | Location | Study Centre & Residence |
|-------|---------------|--------------------------|
| 1. | Same City | 52 |
| 2. | Other City | 4 |
| 3. | Convenient | 17 |
| 4. | Approachable | 18 |
| 5. | Not Responded | - |

REASONS

Mentioned Regarding Study Centre

- Distance is about 50 Kms. from residence—4
- Distance is about 30 Kms. from residence—8

As per the data presented in the table 10, about two-third of the respondents had study centre and residence in the same city. This may be due to the selection of respondents. Considerable number found the study centre convenient and approachable. As the majority of the respondents from a metropolitan city, the distance between the study centre and their residence was manageable. Respondent's Feedback provided by the University. The respondents were requested to give their feedback on various components. The feedback is presented below:

Learning materials

The major reactions of the science learners have been analysed qualitatively and presented in the decreasing order of frequency. The observations are; (the figure given at the end of the statements denotes the frequency of the respondents)

- More than $\frac{3}{4}$ of the respondents (61/81) felt that the material is easy to understand, language is simple, well compiled with latest and update and according to modern trend with appropriate illustrations and helpful in self learning and good; helpful in the competitive examinations.

The other observations are

- Learners have to concentrate on learning material if he/she has to understand the course materials, but one finds that for some sections on scientific concepts were difficult.
- Some needs counselling classes; find language difficulty and learning material complex; and material reaches us very late.
- Scientific terms should be explained with proper examples/ diagrams

are not clear and they are also not fully labelled.

- Some really appreciate the step of the University in the field of education for promoting the knowledge and education in the rural parts, living people and for working persons.
- There should be more audio cassettes for all subjects
- Some find difficulty in PHE-I and PHE-II courses.

Feedback on Academic Counseling

- Attending regularly, quite helpful/well conducted/on time/very helpful/good; it should be held only on Sunday and Saturday (Student felt that academic counselling is necessary for distance education and are quite helpful for studies).
- No special counsellor for specific subject i.e. Botany; rare/very few; very poor, only practical are taken/Hardly counselling is done.

Feedback on Practicals

- Teachers are cooperative/ humble and helpful/teachers and laboratory staff are very cooperative, wanted to teach us the best and as much as they can. No difficulty/good/planned well.
- Difficulty in obtaining leave for fifteen days, practical should be held on Saturdays and Sundays; and should be held more often so that time is not wasted.
- Syllabus is very lengthy and broad so more counselling is needed.
- Improvement is needed on Practical books, sometimes there is lack of cooperation at study centre and IGNOU headquarters

Assignments

- 39 students found that assignments are good for studies and they help in term end examination.
- Sometimes it is difficult to understand questions as they are tricky.
- More time should be provided for completing the assignments or less number of assignments covering most of the course.
- After evaluation assignments are not return to us.
- Some found that questions are not in accordance with study material.

Term End Examination

- Examination is really challenging. 50 % of the students felt that term end examination are in accordance with the distance student mode and are convenient.
- Some of the questions are difficult; more difficult in December examination than June.
- Result comes quite/always late.
- Sample paper can be sent with study material, previous years question papers should be available to the students either at the study centre or internet throughout the year.
- The examination centre ticket always comes late; provision for improvement is still there.

Programmes as per your expectations:

- About 70% of the respondents (54/70) found the programme as per their expectations and only 5 of them were not satisfied at all.
- The following reasons have been listed:
- Good compiled well and flexible. Syllabus is equivalent with other

universities B.Sc. syllabus and saves times and well accommodated with job, enhances career prospects.

- Even M.Sc. should be appended to IGNOU, so that students don't face any problems in pursuing further studies – 3

Over All Experience and Feedback

Respondent's reactions are as follows

- Very good. Study material is very good and informative, easy to study. IGNOU is a very good way to get higher education for working people. Give more knowledge and experience about subjects and other activity and keeps busy for whole year. Also makes students confident to compete for any examination for further higher studies.
- Need of listening to the study material audio cassettes is developing in students.
- The learning materials and assignment do not reach on time. Unplanned management and lack of discipline and cooperation in work and efforts of the students are not appreciated and result is not on time.
- Assignments do not come in time. Assignments marks are not put properly in grade cards, assignments are also not evaluated properly at times.
- Some thought that assignments should be stopped and only students should be evaluated after appearing in final exam only
- According to some) the programme does not finish in 3 years in spite of their regularity in completing all course work; the whole organization not fulfils the expectations, further there is lack of proper guidance & information.
- Beneficial to Career fulfilment.
- As per the respondents feedback the programme was not much beneficial for their career advancement but a graduation degree open so many fields as a option; but they joined just for getting the graduation degree.

Beneficial to learners'

- 49/81 respondents reported that the programme is beneficial to them through enhancement of skill, maximum knowledge and improvement in career and more job opportunities, feel confident for challenges in future. Few more study centres needed for B.Sc.
- M.Sc. programme should be launched by IGNOU.
- Provisional certificates should be given whenever needed by students.
- B.Sc. degree should be given within these 3 years of time.

CONCLUSION

As the use of distance education for Humanities and Social Sciences courses is widely accepted in recent years, there is a still lot of scepticism concerning the offering of science courses through this mode of study. The result of this study indicates that promotion of science courses and programmes by distance education is the need of the hour. This study is an exploration to know the difficulties faced by the students as well as their aspirations and needs.

Observations during this study will strengthen applicability of distance higher education and more so for science higher education. Science higher education should be delivered using conventional as well as modern distance teaching-learning methodology.

The disadvantaged learners should be given due consideration. More courses with market and industry orientation should be offered to help working people to equip and update themselves without sacrificing their job and promotional avenues. If possible mobile learning centres may be created to help learners located in geographically and socially disadvantaged regions. Efforts should be made to provide due publicity of these programme in general and specifically in rural and disadvantaged areas and groups.

BIODATA and CONTACT ADDRESSES of AUTHORS

Dr. Amrita NIGAM, School of Science, Indira Gandhi National Open University is PhD in Botany, at present Reader in Life Sciences, Eighteen years of experience in Open University

Dr. Vibha JOSHI, School of Education, Indira Gandhi National Open University is PhD in Education, at present Reader in Education, Eighteen years of experience in Open University

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