

## Educational Technology

### A Trend Report

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In India researches in the field of educational technology were confined largely to the area of programmed learning. It is difficult, therefore, to avoid mentioning a very crucial development in the field of programmed learning. Leith (1969) in his paper 'Second Thoughts on Programmed Learning' has indicated that many of the 'criterial' features of programmed learning have been modified and with them the techniques and range of applications. Leith sums up his position in the following words: "A programmer, nowadays, seeks to arrange an environment within which learning activities appropriate to the programme's objectives are provided. Sometimes a simple textbook programme (as previously understood) will do. Often cooperative learning, practical work, discussion, simulated situations, and audio-visual media are employed. Teaching machines available at present are too restrictive in their mode of presentation and response facilities to be useful. Their only claim to utility — the prevention of looking ahead — is of doubtful validity."

It is in this context that the present review purports to survey the investigations completed in the field of educational technology, a very large portion of which is occupied, at least in India, by programmed learning.

Though the term 'programmed learning' is not a very old name in the field of psychology and education, the concept is as old as Socrates. Programmed learning does not belong to any one discipline. It sprang up from a bewildering complex of ideas and research ventures in many different disciplines. The names commonly linked with programmed learning are those of Thorndike, Pressey, Skinner, Crowder, Lumsdaine, Tyler, Gagne, etc., who, through their experiments and experiences, have contributed to the fundamental principles of programmed learning. Thorndike (1912), while studying stimulus response systems, held the view that if by a miracle of mecha-

nical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instruction could be managed by print. Fourteen years later Pressey (1926) devised the first teaching machine for scoring multiple choice tests for leading the student forward on the basis of immediate performance. Skinner (1954) gave further concrete shape to the ideas. On the basis of his experiments with the pigeons, he gave the first and the most common type of programme, viz., step by step linear programme. His major contribution to the field of programmed learning is the principle of reinforcement which lies at the very base of programmed learning approach. Deviating from the 'step by step' path, Crowder (1959) came out with the branching programme. It was at this juncture that people started using programmed learning materials through different instructional media. May (1964) and Lumsdaine and others (1961) studied the effectiveness of stimulus and response functions of associated pictorial and verbal representation of the objects by making use of active response. Tyler (1951) can be held responsible for bringing about awareness among teachers towards their teaching objectives — the objectives which are clearly stated and are measurable to assess the success or otherwise of teaching. Programmed learning movement has already gathered momentum in the west. India, too, is not unaware of this movement.

The seeds of programmed learning had been sown in Indian soil in early 60's. By 1965, the Department of Educational Psychology and Foundations of Education in the NCERT, Delhi started disseminating the idea to the educationists, teachers, defence personnel, industrial workers and others by arranging symposia, workshops, sequential training courses, etc. Researches in this area at individual and institutional

levels were taken up by those who were research minded. As a result of the training courses organised by the NCERT, some programmed learning materials were prepared and published in different Indian languages. As the idea became known and popular, it started being adopted by the colleges of education and schools. The Faculty of Education and Psychology of the M.S. University of Baroda was the first to introduce the course on 'Educational Technology and Programmed Learning' at the M.Ed. level in the year 1966. The need to strengthen the research programme in the area of programmed learning and educational technology was felt by various organisations and institutions. The Indian Association for Programmed Learning was set up in 1967 with the following as its major objectives: (i) to undertake, promote, aid and coordinate research and training in the field of programmed learning and educational technology and (ii) to organise inservice training and extension work and disseminate information regarding the techniques, applications and methods of programmed learning and educational technology. In order to achieve these objectives, the association publishes a periodical newsletter and books including papers on important aspects of programmed learning and relevant researches conducted in this area and also organises its annual conferences where experts in different fields from different parts of the country take part in useful discussions and deliberations. At the local level, the Departments of Extension Services have been playing important role in disseminating the idea by arranging workshops and seminars and supporting the budding programmers to prepare and publish their programmes. In the area of research, the Centre of Advanced Study in Education, M.S. University of Baroda, selected programmed learning as one of the major research areas and researches were carried out at master's, doctoral and institutional levels. The NCERT, certain State Institutes of Education, Delhi University, Meerut University, etc., are also conducting researches in programmed learning. Similarly, some of the institutes looking after technology and industry are also exploring the uses of programmed learning. An attempt is made here to survey the researches in programmed learning conducted at doctoral level and at institutional level in the country and to trace the trend these researches have followed. The researches, considering the different aspects of programmed learning touched by them, have been categorised as follows:

- (1) Programmed Approach vis-a-vis Traditional Approach to Teaching

- (2) Different Forms of Programmed Learning Materials
- (3) Different Uses of Programmed Learning Materials
- (4) Programmed Learning for Different Subjects
- (5) Programmed Learning and Instructional Media
- (6) Programmed Learning and Individual Differences

*Programmed Approach vis-a-vis Traditional Approach to Teaching :*

Programmed learning, in its earlier stages, was deemed solely as a technique of teaching in the classroom. In order to find out its effectiveness, the earlier researches were on comparison between programmed learning approach and traditional approach. The programmed learning materials used for these studies were in the subjects like, mathematics, geography and languages. The subjects were assigned to two treatment groups — experimental group and control group. The experimental group, in the study of Shah (1964), was given a programme on 'Solving Equations'. Sharma (R. A. 1966) administered programmed learning material in geography, whereas Sharma (M. M., 1966) administered a programme in algebra. Desai (1966) studied the effectiveness of programmed learning by using the programmed learning material on 'Teaching of Gujarati in Standard IX'. An intensive study was made by Shah (1969). She programmed the whole syllabus of algebra of standard VIII and the experimental group studied the whole syllabus of algebra through this technique. The findings of all these studies revealed that the group taught through the programmed learning material achieved higher on the post test as compared to the group which was taught by teachers in the traditional way. These findings are not limited to the urban area only. The studies by Sharma (R. A., 1966) and Sharma (M. M., 1966) included samples from rural areas also. The study conducted by SIE (1970a) confirmed the findings of the above researches.

The effectiveness of programmed learning approach was not only studied in terms of immediate scores on the post test, it was studied in terms of retention too. Sharma, (M. M., 1966), Kulkarni (1969) and SIE (1970a) found that the retention scores of the experimental group were better than those of the control group.

Shah (1964) introduced another variation in her study. She had three treatment groups in her study.

The first experimental group was given the programmed material and was asked to study on its own. The second experimental group was helped by the class teacher to learn by the programmed material and the control group was taught by the traditional method of teaching. The finding that the group taught through programmed material along with the teacher's help failed to do better, is very interesting.

The two approaches – programmed learning and traditional – were compared in terms of one more variable, i.e., time taken to learn a particular topic. Shah (1964) and Shah (1969) found that the experimental group achieved more in less time. This indicates that programmed learning approach is effective not only in terms of immediate and delayed achievement, but also in terms of time taken to learn a particular topic.

Apart from the empirical evidences, the effectiveness of the approach was judged by analysing the pupils' reactions. Desai (1966) found that the pupils preferred to study through programmed learning approach to the traditional approach.

Pandya (1974) studied the effectiveness of programmed learning strategy in learning physics and found that the experimental group achieved more.

Reddy (1975) compared the programmed learning with conventional learning in the instruction of language. There were some definite advantages found in the programmed learning method over the conventional method.

Mehta (1973) developed and validated a programme in English for developing reading ability at the initial stage. The performance of the experimental group studying with self-instructional programme was found to be much superior to that of the teacher-taught group with respect to both acquisition and retention of reading skill in English. It was a linear programme developed for children of class V in the State of Gujarat.

#### *Different Forms of Programmed Learning Materials :*

When Skinner's influence was quite dominating in the field of programmed learning, those who used Skinnerian technique held certain views and practised certain rules such as only overt responses suitably reinforced are learned and therefore, the student must 'write' the response. The only type of programmed materials known to people till 1959 was the linear type. Crowder (1959) made people aware of another possibility of presenting programmed material. The controversy was started on 'whether linear or branching'. Comparative studies were conducted to deter-

mine the superiority of one over the other. Not stopping at this point, the programmers and the researchers started evolving different modes of response, combining two forms of programming to see which response mode or form of programmed material was more effective.

Shah (1971) studied the effectiveness of four response modes using a programme on 'Addition and Subtraction of Directed Numbers'. The four response modes studied were A : overt-answer not given, B : overt-answer given (response prompt), C : covert-answer not given, and D : covert-answer given (response prompt).

The results revealed that the response mode D, wherein the pupils had to read the answer already given in the blank, was the most effective as far as immediate scores were concerned. When the retention scores were analysed, response mode B was found to be superior in school I, whereas response mode C was found to be superior in school II. Considering the time factor, response mode D seemed to be the least time consuming.

Krishnamurthy (1972) studied seven different forms of programmed learning materials. Besides the four response modes studied by Shah (1971), he included branching, skip-programme and hybrid (linear and branching combined), the last two forms being devised by him. Seven different forms of the programme on 'Thermometers' were prepared. One of his findings is in conformity with that of Shah's (1971), i.e., covert response prompt form is the most effective as far as immediate achievement is concerned.

One more study by Kulkarni and Yadav (1966) attempted to find out the relative effectiveness of linear, branching and simple programme (without providing immediate knowledge of results) on the development of knowledge, comprehension and application objectives for 'Solving Simple Equations'. The results showed that the treatment effects did not differ significantly.

Gupta, A. K. (1973) studied the interaction between step size and response mode for a programme in action research. The study revealed that the small step was more effective with overt response and showed the least retention, while the large step was more effective with covert response and showed highest retention. The small step was more effective for knowledge category and the large step was for application category.

Bhushan (1973) attempted to study the linear programme in educational statistics. It was concluded that the mean of attainment scores was 78 percent and

that of gain scores was 76.8 percent. Average performance was almost equal at the knowledge and application levels.

Singh (1973) studied the effectiveness of formal and thematic prompts in a linear programme in geography in map reading. It was found that thematic prompts were more effective.

More studies in this area would give us the programmed forms which are more effective, less time consuming and less costly, because the main handicap in popularising the idea is the dearth of available programmed materials. Another way of solving the problem of preparing programmed learning materials within a short time is to adapt the programmes prepared in other countries to suit our conditions. Gupta (1965) studied the possibility of adapting programmed learning materials on 'Force' in physics developed abroad, for use in our country. The modified version of the programme was administered to one group of students and their performance was compared with another group of comparable students who were taught the same topic by usual method. In the second phase, the adapted programme was compared with the original programme. The findings revealed no significant differences between the group studying the topic through the adapted programme and the group taught by the teacher. The lower ability students benefited more by the adapted programme than by the original programme. The study indicated that adaptation could save a lot of time as compared to preparing a programme anew on the same topic.

#### *Different Uses of Programmed Learning Materials :*

Apart from being used as a teaching technique, programmed learning has been used for revising a particular topic already learnt. It has also been used as a remedial material to help underachievers. Its use in correspondence courses is also explored.

Kulkarni (1969) and SIE (1970b) reported that students using programmed material for revision were significantly better than students who adopted other methods of revision.

Programmed learning was used for remedial teaching in two Indian studies. Joshi (1972) used programmed material for remedial teaching for the first year degree students at Hyderabad, whereas Shah and Kapadia (1972) used programmed material for underachievers in algebra among the students of standard VIII in a rural area. Both the studies indicated that learning through programmed way helped the students to improve their achievement.

Mullick (1964) found that the experimental group, which was sent programmed lessons in a cor-

respondence course, performed significantly better than the control group which was given the lesson prepared on conventional lines.

#### *Programmed Learning for Different Subjects :*

Preparation of good programmed learning materials lies at the very base of programmed learning movement. The extensive use of programmed learning approach in education, defence, health and industries is not possible without adequate programmed learning materials. They are needed for research purpose as well. It is not very uncommon to prepare programmed learning material first and then use it as a tool for the research. When programmed learning had just started taking roots, a few researches were conducted in the areas of development and validation of programmed learning materials in different subjects. Most of the programmed learning materials were developed in mathematics and physical sciences, mainly because of their less descriptive nature.

Shah (1964), Shah (1969), and Kulkarni (1969) developed and validated programmed learning materials in algebra, and studied their effectiveness in relation to different variables. The programme prepared by Shah (1964) was in English language and that prepared by Shah (1969) was in Gujarati language. The programme developed by Kulkarni was in Marathi. All these programmes were of the linear type.

Krishnamurthy (1972) developed a programme in physics on 'Thermometer', through the medium of English. Later, he prepared seven different forms of the same programme having common pretest and post test.

Kapadia (1972) developed and validated a programme in physiology on 'Heart and Blood Circulation' in English as well as in Gujarati.

Sharma (R. A., 1966) developed a programme in geography on the following topics : 'Shape of Sun and Earth', 'Earth's Rotation and Revolution', 'North and South Poles', and 'Latitudes and Longitudes.' Hussain (1971) developed a programmed learning material in geography on 'Factors Affecting Air Pressure' and studied its effectiveness under supervised and non-supervised conditions in rural and urban areas. The programmed learning materials were prepared in two forms, viz., linear and branching.

Dewal (1974) investigated the difficulties in teaching English and also the effectiveness of programmed strategy. The study revealed the effectiveness of programmed teaching. Gupta (O. N., 1973) developed a self-instructional programme in basic sentence pattern of English for the graduate students. The study

evaluated in terms of programme density, error rate and sequence progression separately for definitions and structures. The programme density for the frames on definitions ranged from 0.4 to 0.15 and the error rate for the same frame ranged from 1.2 to 3.4. The programme density for the frames on structures ranged from 0.4 to 0.08 and the error rate for the same ranged from 1.4 to 3.2. The average density and error rates for the complete programme taking the parts on definitions and structures together were 0.06 and 2.0 respectively.

Chauhan (1973) studied the programmed text in educational psychology for B.Ed. level. It was found that the error rate did not exceed 8.72 percent, the density of the programme calculated by taking into account the number of frames and number of responses expected was found to be 1.117, the sequence progression for each unit was normal, and students expressed favourable opinion.

#### *Programmed Learning and Instructional Media :*

The use of instructional media like teaching machines, tape recorders, films, television and computer is almost nil in India. The most common medium used for presenting the programmed material is the programmed book.

The first Indian study in which principles of programmed learning were applied to televised instruction was that of Dewan (1966). The experimental group which was given televised instruction in a programmed way was superior to the control group which received television lessons in the usual way.

Roy (1974) studied the cognitive effects of the ETV programmes broadcasted by the Delhi TV centre. It was found that students were not having the overall cognitive effects out of the TV lessons and the most affected were the assimilation and utilisation bases.

#### *Programmed Learning and Individual Differences*

As programmed learning is an auto-instructional technique, it makes provision for the learner to proceed at his own pace. It also aims at meeting the needs of the individual learner in terms of his different characteristics.

Shah (1964), Desai (1966), Nagar (1971) and Kapadia (1972) studied pupils' intelligence in relation to achievement on programmed learning materials. Shah, Desai and Nagar reported that differences in intelligence did not have an impact on achievement in a post test after going through programmed learning material, but Kapadia's study indicated that high intellectual ability did help the pupils to achieve bet-

ter on programmed learning material. Kapadia's study ascertained the fact that personality variables like anxiety, self-sufficiency and introversion-extraversion were not significantly related to the achievement on linear and branching programmes.

Shah (1969) and Kulkarni (1969) tried to study the effectiveness of programmed learning with the students from lower grades not having required entering behaviour. Shah reported that if some technical terms were explained by the teacher, the pupils of standard V could learn the topic of standard VIII through the programme and could answer the items of the post test quite satisfactorily. But these pupils of standard V took almost double the time taken by the pupils of standard VIII to complete the programme. Kulkarni's study showed that the pupils not having specified entering behaviour did significantly better after completing one revision only, if they used programmed material for revision.

#### *Research Needs in Programmed Learning and Educational Technology*

A perusal of research studies in programmed learning shows how limited are the researches in this area. The aspects of programmed learning covered by the researches surveyed are also very limited not to talk of their quality. Except for a few studies including those conducted at doctoral level, the others are very sketchy, hardly leading to any generalisable conclusion.

One of the ways of strengthening research programmes is to have a pool of programmes in different subjects, adapted in different regional languages, to be used by learners at various levels. The NCERT, the State Institutes of Education and the Departments of Extension Services should provide such facilities to the programmers. There should be a separate cell of programmed learning in institutes like the NCERT and the SIEs where a team of programmers and subject matter experts work together to develop and adapt the programmes. The programmes prepared during the training courses should be followed up, edited and published if they meet the required standards. The agency at national level should specify the standards for the programmes to be put on the market.

Since the effectiveness of programmed learning approach as compared to traditional approach has long been established, it is high time the researchers shift their focus to other aspects of programmed learning which need to be explored. More intensive study needs to be made in the area of different forms of programmed learning materials covering other aspects like step size, reinforcement schedules, number of

errors made by the learners, etc. Such studies are of utmost value to establish a form or forms which are suitable to Indian conditions and are effective in terms of time, money and achievement. Semi-programmed textbooks need to be tried out to find out how effective they are.

More researches are needed in the area of multifarious use of programmed learning materials. Its use for giving homework to the pupils, its use as substitute and supplement to teacher's teaching, its use under supervised and non-supervised situations, in rural, urban and semiurban areas are some of the aspects which, if explored, would throw light on some practical issues.

Emphasis should also be given to application of programmed approach and extensive researches should be conducted to find out the possibility of using the programmed approach with learners of different levels, i.e., from preschool children upto adults.

Another area to be explored is that of individual differences. Rather than taking it for granted that programmed learning works effectively with the learners of all types and abilities, it is better to find out

the individual characteristics of learners which are more amenable to programmed learning. Relationship between different forms of programmed material and different personality characteristics of learners could be studied. This would add to the effective use of programmed materials with all types of learners.

Mass media like radio or television (Delhi) have been used to broadcast educational programmes for more than fifteen years. By now, a few studies have been conducted on the utilisation of mass media. Researchers should concentrate upon the effectiveness of mass media on students' achievement, differential effects of programmes on different types of students in different types of schools.

Nonformal and adult education is another area where educational technology can play a very significant role. We can look upon the low cost projective equipments being developed by specialists in mass communication.

Researchers can utilise the opportunity of experimenting in adult and nonformal education area so that this national programme gets the benefit of the advanced educational techniques for its effective implementation.

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## ABSTRACTS : 454-475

454. BHUSAN, A., *An Experimental Study of a Linear Programme in Educational Statistics for B.Ed. Student-Teachers*, Ph.D. Edu., Mee. U., 1973.

The main objectives of the study were : (i) to prepare a linear programme in educational statistics using Hindi as the medium of presentation; (ii) to study the workability of the programme for various levels of qualifications, age, motivation, intelligence and for different sex; and (iii) to prepare a manual for the guidance of the consumers of the programme.

The sample consisted of fortytwo (twentyseven males and fifteen females) B.Ed. student-teachers taken from a college of education situated in an urban setting in the jurisdiction of Meerut University. The final draft of the programme was analysed with the computation of the three measures of density. The mean value of the density as measured by the ratio of different frames was found to be 0.263. The mean value of density as measured by the ratio of the number of different frames to the total number of response was found to be 0.194 approximately. The third index of density formed the ratio of the first two. As for techniques used, the frame sequence was studied with a pictorial representation and the sequence progression was studied with the help of scalogram. Product moment coefficient of correlation, t test, and point biserial coefficient of correlation were used to analyse the data.

The findings revealed that (i) the mean of the attainment scores on post test was found to be seventyeight percent; (ii) the percentage of mean of modified gain scores was obtained as 76.8; (iii) the average performance of students at the knowledge and application levels was almost equal in amount and identical in composition; (iv) the correlation ratios of post test scores on pretest scores, performance errors and the ages of the students were found to be highly significant and dependable; (v) the post test scores were neither related with sex variable nor with the initial levels of the students in mathematics; (vi) the post test scores were significantly correlated with intelligence and attitude scores and were independent of time taken by the students in covering the programme; (vii) the Pearson's coefficients of correlation between time taken and intelligence scores revealed a significant and negative relationship, whereas the same between time taken and attitude scores indicated a marginal relationship; (viii) average attainment score of female group was found to

be higher but less variable than the male group; (ix) the students of lower qualifications performed equally well on criterion test when compared with their counterparts; and (x) the value of t ratio for post test scores was not significant, whereas it was significant for the criterion of time taken.

\*455. CHANDRAKALA, *An Experimental Study of Different Methods of Teaching Sanskrit Grammar to High School Classes*, Ph.D. Edu., HPU, 1976.

The objective of the study was to evaluate the functional effectiveness of the programme on Sanskrit Grammar at high, average and low academic achievement. Three alternative treatments, viz., Programmed Instruction (PI), Lecture Method (LM) and Traditional Method (TM) were tried out at three levels of achievement.

The sample of the study constituted 172 students from standard IX. A factorial design of 3 x 3 model was applied.

The findings of the study were : (i) the three treatments, viz., PI, LM and TM, were equally effective in terms of students' performance; (ii) high and low achievers learnt equally well through PI; (iii) average achievers learnt better than high and low achievers through PI; and (iv) high achievers learnt better than average and low achievers through LM and TM.

456. CHAUHAN, S. S., *Developing a Programmed Text in Educational Psychology for B.Ed. level*, Ph.D. Edu., Mee. U., 1973.

The objectives of the study were : (i) to evolve a suitable programme in educational psychology for B.Ed. level; (ii) to provide auto-instructional material in educational psychology which may be used as supplementary materials for the course; and (iii) to meet the growing challenges of providing in-service training to teachers.

The sample consisted of 150 student teachers. The entire programme consisted of eight units which covered the developmental process, learning theory, conditioning, motivation, remembering and forgetting, transfer of learning, problem behaviour, and action research. The programme was tried out with individual tryouts, small group tryouts and field tryout. The final programme was evaluated in terms of error rate, density and criterion test. The programme was further evaluated by obtaining the reactions of the student teachers on a reaction checklist consisting of

ten statements. Mean, median, mode and SD were calculated for the scores on the criterion test.

The study revealed that (i) the error rate of the entire programme did not exceed 8.72 percent; (ii) the density of the programme calculated by taking into account the number of frames and number of responses expected was found to be 1.117; (iii) the sequence progression for each unit was fairly normal; and (iv) the opinion expressed by the student teachers was found to be favourable towards the programme.

457. DEWAL, O. S., *A Study of Difficulties in Teaching English and Effectiveness of Programmed Teaching*, Ph.D. Edu., MSU, 1974.

The major objectives of the study were : (i) to study teachers' perception of difficulties which hampered effective teaching and learning of English; and (ii) to study the effectiveness of programmed teaching.

For the first part of the study ninetythree English teachers of Udaipur constituted the sample. A total of 160 students of class VIII of four government schools of Udaipur city were employed as the sample for the second part of the study. As for tools, a questionnaire was administered to the teachers for the purpose of data collection. A pretest, programme and the post test were administered to the students.

The study revealed that (i) the difficulties hampering effective teaching and learning of English were due to the shortage of trained teachers, lack of subject competence in teachers, dearth of good teaching - learning material, lack of individual attention, and poor socio-economic background; (ii) programmed teaching overcame some of the felt difficulties of the teachers and helped students to perform significantly better than those who were taught by conventional method; and (iii) the strategy proved useful in a situation where teachers were underqualified and untrained in teaching English.

\*458. GOSAIN, K. K., *A Study of a Linear Programme on Elementary Algebraic Concepts in Relation to Step Size and Three Levels of Taxonomic Categories*, Ph.D. Edu., HPU, 1977.

The objective of the study was to study the interaction if any between step size of a linear programme with (i) taxonomic category, (ii) sex, and (iii) taxonomic category and sex.

The target population of the study was VI grade students. A total of 300 students, randomly selected, comprising 150 boys and 150 girls formed the sam-

ple of the study. The tools used were six programme sets and an achievement test. The design followed was a 2 x 2 x 3 mixed factorial one, involving 2 levels each of sex and step size and 3 levels of taxonomic categories.

The main findings of the study were: (i) small step programme was more effective with regard to achievement; (ii) there was no relation between sex and attainment through programmed instruction either in small steps or large steps; (iii) small step programme was more effective for knowledge and comprehension categories, whereas they were equally effective for application category; (iv) boys performed better in the comprehension category; and (v) small step programme was significantly more effective than large step programme for both boys and girls with respect to knowledge and comprehension categories.

\*459. GOVINDA, R., *Development of a Programmed Text on Educational Evaluation and Experimentally Studying its Effectiveness as Instructional Material for B.Ed. Students*, Ph.D. Edu., MSU, 1976.

The major objectives were : (i) to develop a programmed text for the course, 'Educational Testing and Techniques of Evaluation' as specified in the B.Ed. syllabus of the M.S. University Baroda; (ii) to experimentally validate and study the effectiveness of the programme; (iii) to develop an attitude scale and measure students' attitude towards programmed learning; (iv) to study the relationships of achievement with attitude towards programmed learning, intelligence, academic motivation and English language comprehension; and (v) to study the relationships of attitude towards programmed learning with intelligence and academic motivation.

A matched group design was adopted for conducting the experiment. The study was conducted on sixtynine B.Ed. students of the M.S. University of Baroda of 1973-74 session. The group was divided into a thirtyfive member experimental group and thirtyfour member control group. An attitude scale of Thurstone type was prepared. The scale was administered after the students had completed two units of the programmed text. The mean percentage of all the six criterion tests was computed and correlated with the scores on attitude test, intelligence test (the Raven's Progressive Matrices), achievement motivation (JIM scale) and the English language comprehension test developed by the investigator on the basis of the Michigan Test of English Language Proficiency. The statistical techniques employed were rank

correlation, product-moment correlation, chi-Square and time series analysis.

The study revealed that : (i) a programmed text is as effective as structured lectures; (ii) eighty per cent of the students had favourable attitude towards programmed learning; (iii) students with more favoured attitude achieved higher scores; (iv) intelligence and achievement motivation had no definite effect on achievement; (v) there was no significant relationship between attitude of students towards programmed learning and their intelligence; and (vi) there was no significant relationship between attitude of students towards programmed learning and their academic motivation.

460. GUPTA, A. K., *A Study of Interaction between Step-Size and Response Mode for a Programme in Action Research*, Ph.D. Edu., Mee. U., 1973.

The main objectives of the study were : (i) to study the interaction effects between step-size and response mode, step size and taxonomic category, and response mode and taxonomic category; (ii) to study the retention in learning through programmed material; and (iii) to evaluate the effectiveness of the two forms of programmes in terms of internal criteria like error rate, programme density, sequence progression and the usual 90/90 criterion. The hypotheses tested were : (i) there would be significant interaction between step-size and response mode, between step-size and taxonomic category, and between response mode and taxonomic category; and (ii) there would be significant difference in the retention of learning among the four treatment groups.

The sample consisted of 100 male and female student teachers of J. V. Jain College, Saharanpur. It was randomly divided into four groups of twenty-five students each. These four groups were randomly assigned to the four treatments. The study was a 2 x 2 x 3 mixed factorial design with three factors, namely, step-size (small and large), response mode (overt and covert) and taxonomic category (knowledge, comprehension, and application) having two, two and three levels, respectively. The criterion test was re-administered as the delayed test after a gap of fifteen days. Three-way analysis of variance was used for data analysis.

The major findings were : (i) the small step programme was more effective with overt response mode; (ii) the large step programme was more effective with covert response mode; (iii) the small step programme was more effective for knowledge category, whereas the large step programme was more

effective for comprehension and application categories; (iv) the small step programme with overt response mode was more effective for knowledge category and large step programme with covert response mode for application category; (v) the retention in learning by large step and covert respondents was higher than all other experimental groups; and (vi) the small step and overt responders' group showed the least retention in learning through programming.

461. GUPTA, O. N., *Developing a Self-Instructional Programme in Basic Sentence Patterns of English for the Undergraduate Students*, Ph.D. Edu., Mee. U., 1973.

The study attempted to develop a self-instructional programme in the basic sentence patterns of English for the undergraduate students and to make an empirical study of the programme on the basis of field testing.

The study involved three samples selected from local colleges of Meerut. The first tryout was administered on a sample of six undergraduate students and then on four small groups of five students each. Subsequent to this, a group consisting of eightyone students was selected for empirical tryout and another group comprising seventy students was taken for final field testing. The programme was subjected to individual, group and field tryouts and was amended and modified.

The final version of the programme was evaluated in terms of programme density, error rate and sequence progression separately for the two major parts, viz., definitions and structures. The programme density for the frames on definitions ranged from 0.4 to 0.15 and the error rate for the same ranged from 1.2 to 3.4. The programme density for the frames on structures ranged from 0.4 to 0.08 and the error rate for the same ranged from 1.4 to 3.2. The average density and error rates for the complete programme taking the parts on definitions and structures together were 0.06 and 2.0, respectively.

\*462. KURUVILLA, R., *An Experimental Study in the Use of Programmed Learning Material in the Classroom*, Ph.D. Edu., MSU, 1977.

The major objectives of the investigation were : (i) to study the relative effectiveness of the four forms of programme, viz., linear overt, branching, skip, and response prompt in terms of (a) performance of the students on the post-test and (b) time taken to complete the programme; (ii) to study the difference in mean achievement of the students when adjusted for their reading comprehension; (ii) to study the relationship between performance of the students

on post test and reading comprehension, academic motivation, dependency, and total adjustment; and (iv) to study the relationship between performance of the students on post test and programme time, and their attitude towards programmed learning.

The population under study consisted of VIII standard students of English medium schools of Baroda. For tryout 54 students of a school were taken and divided into four groups randomly. For final study three schools were selected randomly and all the 301 students of VIII standard in these schools constituted the sample. All the students of each school were divided into four groups and random replication design was used for the study. The tools used for the study were (i) Frymer's Junior Index of Motivation Scale; (ii) the Pre-Adolescent Adjustment Scale by Pareek et al.; (iii) the Pre-Adolescent Dependency Scale by Pareek et al.; (iv) a reading comprehension test; and (v) an attitude scale. The data obtained were analysed through analysis of variance, t test, percentiles, partial correlation, and product moment correlation.

The major findings of the study were : (i) Eighty percent of the students who had learnt through different types of programmes had scored eighty percent or above. (ii) The branching form was significantly more effective than other forms when students' performance and time were taken as criteria. (iii) There was positive and significant relationship between performance of students on post test and reading comprehension on each form separately. (iv) There was no significant relationship between performance of students on post test and academic motivation on linear overt, branching and response prompt forms; but skip programme had a positively significant relationship. (v) Most of the students had positive attitude towards programmed learning.

463. PANDYA, N. L., *A Study of the Effectiveness of Programmed Learning Strategy in Learning of Physics in X Class of Secondary Schools*, Ph.D. Edu., SPU, 1974.

The objectives of the study were : (i) to determine if the instruction given by programmed learning method resulted in significant gain in learning by the students; (ii) to determine if there was any relationship between intelligence, achievement motivation and amount of learning that occurred; and (iii) to determine whether or not the students liked programmed learning method. The hypothesis was that the achievement of the group learning through programmed method would be more than that of the group learning through conventional method.

The investigator wrote programmes on 'light' which were tried out in class X of different schools. The criterion tests were developed. A sample of class X students of six schools in the rural areas of the four districts of Gujarat State was selected. Out of these, three classes of three schools were treated as experimental group which was taught through the programme and three classes of the other three schools as the control group which was taught through the conventional method. Data about achievement motivation, SES, and IQ were also collected. Analysis of variance and covariance were employed to compare the achievement of the experimental and control groups.

The major findings of the study were : (i) the experimental group achieved more in all the four tests; (ii) the gain of the students of the experimental group at the post test scores was significantly greater than the pretest scores; (iii) learning through programmed learning material benefitted the students with high, middle and low IQ; (iv) when the effect of the variable of motivation was partialled out, the adjusted mean scores showed that the experimental group achieved higher than the controlled group; and (v) the developed programme gave enough challenge to lowly motivated pupils than to highly motivated pupils.

464. PATEL, A. D., *Development and Tryout of Auto-Instructional Programmes in Some Units of Geometry for Class VIII and to Study its Effectiveness in the Context of Different Variables*, Ph.D. Edu., SPU, 1977.

The major objectives of the study were : (i) to develop programmed learning material (PLM) in some units of Geometry for class VIII; (ii) to compare the achievement in mathematics of students having different reading abilities, and learning through PLM and traditional way of teaching; (iii) to compare the achievement in mathematics of the students having different study habits, and learning through PLM and traditional way of teaching; and (iv) to compare the achievement in mathematics of students with respect to anxiety and n-Ach. when taught through PLM and traditional way of teaching.

The sample consisted of 810 students of class VIII studying in fourteen schools of Kaira District. The sample was selected keeping in view the following criteria : (i) the strength of the school, (ii) the area whether urban or rural, (iii) type of school, and (iv) SSCE results. The achievement of the students was measured through teacher made tests. The differences between different groups were studied by

calculating mean, SD and t values.

It was found that (i) the auto-instructional material does not work well with pupils having low n Ach.; (ii) in case of highly motivated students the material was found to be working well; (iii) the PLM was found to be effective for the pupils who had good study habits as well as those who had poor study habits, when compared to traditional way of teaching; (iv) learning through auto-instructional programme in case of students having poor reading ability was not more effective than the conventional method but it was superior in case of students who had good reading ability; and (v) the more anxious students could learn better through PLM than their counterparts.

\*465. PATEL, C. B., *To Develop Auto-Instructional Programmes in Geometry for Std. IX and to find out their Effectiveness in Relation to Different Variables, Ph.D. Edu., Guj. U., 1975.*

The study attempted to develop programmed learning material in Geometry for standard IX and to study its effectiveness in the context of different variables.

Fourteen classes of fourteen rural and urban high schools formed the sample of the study. The tools used in the study were: (i) the Desai's Intelligence Test; (ii) the Kuppaswamy's Socio-Economic Status Scale; (iii) test on entering behaviour; (iv) test on terminal behaviour; (v) opinionnaire for the students; and (vi) interview schedule for interviewing teachers.

The findings of the study were: (i) the programmed learning material (PLM) proved to be more effective than conventional method; (ii) high and low IQ groups of students performed better with PLM than with conventional teaching; (iii) the average time taken by the group learning through PLM was less than that of the group taught by the traditional method; and (iv) students from different strata of the society performed better with PLM than with conventional teaching.

466. REDDY, N. Y., *Programmed Learning vs. Conventional Learning in the Instruction of Language — a Comparative Study, Dept. of Edu., Osm. U., 1975. (NCERT financed)*

The main purpose of the study was to compare the programmed instructional method with that of the conventional teaching method. It was hypothesised that the programmed instructional method was more effective than the conventional learning method.

The sample for the study was drawn from grade

VI of the Keshav Memorial High School. The study followed simple matched group design. Two groups were formed after matching on the factors, namely, age, intelligence, father's income, and the contents of instructional material. The Raven's Progressive Matrices were used to measure intelligence and a personal data sheet was used to measure other factors. The experimental group was exposed to programmed learning techniques, and the controlled group was exposed to conventional learning techniques. Mean, standard deviation and critical ratio were used to compare the two groups.

The main findings of the study were as follows. Mean performance scores of the experimental group on all the five programmes, viz., linear programmes, intrinsic programmes, branching programmes, mathematics programmes, and language programmes, were higher than that of the controlled group. Critical ratios, in the beginning, showed that the differences between the mean scores of the two groups were not statistically significant. As the subjects progressed in their work, the subjects in the programmed learning group made a significant gain. On the last two lessons, mean scores of the programmed instruction group were higher than that of the conventional instruction group. There were some definite advantages found in the programmed learning method over the conventional method.

467. ROY, B., *A Study of the Cognitive Effects of the ETV Programmes Broadcast by the Delhi TV Centre, Dept. of Educational Psychology and Foundations of Education, NIE, New Delhi, 1974.*

The project aimed at studying the cognitive effects of the ETV programmes broadcasted by the Delhi TV Centre. The specific objectives of the study were: (i) to find out the present situation through observations of the teachers and students on an impressionnaire about the cognitive effects of the ETV programmes through four bases of cognition; and (ii) to study any probable effect of two variables (TV teaching and discussion). The hypotheses tested were: (i) there would be a significant difference between TV teaching followed by discussion and TV teaching followed by no discussion ( $A_1B_1 \sim A_1B_2$ ); (ii) there would be a significant difference between TV teaching followed by discussion and non-TV teaching followed by discussion ( $A_1B_1 \sim A_2B_1$ ); (iii) there would be a significant difference between TV teaching followed by discussion and non-TV teaching followed by no discussion ( $A_1B_1 \sim A_2B_2$ ); (iv) there would be a significant difference between TV teaching followed by no discussion and non-TV teaching follow-

ed by no discussion ( $A_1B_2 \sim A_2B_1$ ); (v) there would be a significant difference between TV teaching followed by no discussion and non-TV teaching followed by no discussion ( $A_1B_2 \sim A_2B_2$ ); and (vi) there would be a significant difference between non-TV teaching followed by discussion and non-TV teaching followed by no discussion ( $A_2B_1 \sim A_2B_2$ ).

The sample comprised the students of class X in science stream of two classes, each of which was divided into two matched groups as class I —  $A_1B_1$ ,  $A_1B_2$  and class II —  $A_2B_1$ ,  $A_2B_2$ . Both the classes were taken in the same school where ETV was being used for classroom purposes. The instruments prepared and administered were : (i) an opinionnaire having thirtyeight items meant for both the TV teachers and the students; and (ii) a test based upon the lesson which the TV teacher gave.

The findings of the study were as follows : (i) the opinionnaire revealed that nearly half of the students were not having the overall cognitive effects out of the TV lessons; and (ii) the most affected were the assimilation and utilisation bases out of the four bases.

\*468. SANSANWAL, D. N., *An Experimental Study in Programmed Learning for Teaching Research Methodology Course at M.Ed. Level, Ph.D. Edu., MSU, 1978.*

The following were the objectives of the study : (i) to develop the instructional material for each of the components for teaching the course on 'Research Methodology' as specified in M.Ed. syllabus at the M.S. University of Baroda; (ii) to study the effectiveness of the instructional strategy as a whole in terms of students' performance on criterion tests and a comprehensive test; (iii) to study the effectiveness of individual components of instructional strategy in terms of students' reaction to each of its components; (iv) to study the relationship between achievement through the instructional strategy and the following students' characteristics:- (a) intelligence, (b) academic motivation, and (c) English language reading comprehension; (v) to compare the achievement of students of (a) high, average and low intelligence by taking academic motivation and English language reading comprehension as covariates; (b) high, average and low academic motivation by taking intelligence and English language reading comprehension as covariates; and (c) high, average and low English language reading comprehension by taking intelligence and academic motivation as covariates; (vi) to study the students' reactions towards instructional strategy with respect to their level of (a) achievement, (b) intelligence, and (c) academic motivation; and (vii) to study the trend

of change in students' reactions towards instructional strategy and their academic motivation over the period of experimentation.

All the 37 full-time M.Ed. students during 1975-76 in the M.S. University of Baroda formed the sample for the tryout of the material developed for each component of the instructional strategy which included programmed learning material, library work, discussion and seminar. All the 24 M.Ed. students and 43 M.Sc. students of the Faculty of Home Science of the same university who had opted to study the research methodology course along with the M.Ed. students during 1976-77 formed the sample for the main study. The following tools were used : (i) the Raven's Standard Progressive Matrices, (ii) an English language reading comprehension test developed by Govinda, (iii) the Junior Index of Motivation Scale, and (iv) a students' reaction scale developed by the investigator. Mean, SD, percentage, percentiles, partial correlation, t test, and analysis of covariance were used for the analysis of data.

The major findings of the study were : (i) The instructional strategy was found to be effective in terms of students' achievement on criterion tests. (ii) Individual components and instructional strategy as a whole were found to be effective in terms of students' reactions. (iii) Achievement of students through instructional strategy was found to be significantly related with intelligence but was not significantly related with academic motivation as well as English language reading comprehension. (iv) The mean achievement score of students belonging to high intelligence group was significantly higher than that of average and low intelligence group students. Also, the mean achievement of students belonging to average intelligence group was significantly higher than that of low intelligence group. These were the results when the mean achievement scores were adjusted with respect to their academic motivation and English language reading comprehension. (v) The mean achievement scores of students belonging to high, average and low academic motivation groups did not differ significantly when the achievement scores were adjusted with respect to intelligence and English language reading comprehension. (vi) The mean achievement scores of students belonging to low English language reading comprehension group was significantly lower than that of the students belonging to high as well as average English language reading comprehension groups. (vii) A large majority of students from high, average and low achievement groups had favourable reactions towards individual instructional components and thereby towards the instructional strategy as a whole.

- \*469. *SETHI, A. S., A Study of a Programme in English Spelling in Relation to Visual and Auditory Presentation, Ph.D. Edu., HPU, 1976.*

The objectives of the study were to find out : (i) the relative merits of visual and auditory modes of presentation for learning programmed material; (ii) the comparative effects of visual and auditory modes of presentation of programmed material performance on delayed test; and (iii) the comparative effects of visual and auditory modes of presentation of programmed material among boys and girls.

The sample consisted of 180 boys and girls studying in standard X of four English medium high schools at Simla. The McClelland's T.A.T., and Verbal Reasoning Test were used in the study. Analysis of variance and t test were employed to analyse the data.

The findings were : (i) The auditory mode was found to be superior to the visual mode in presentation of the programme in English spelling to class X students of English medium schools. (ii) Girls performed better than the boys. (iii) The auditory and sex interaction was found to be not significant. The auditory and time factors were found to be not significant. (iv) The interaction difference in the performance of boys and girls appeared to be independent of the modes of presentation. (v) Time of test appeared to have a significant effect on the performance of boys and girls. (vi) Boys seemed to perform better on the delayed test in terms of their performance and the immediate tasks. (vii) The auditory mode of presentation was more effective for performance on the delayed test.

- \*470. *SHARMA, H. C., A Study of a Programme in a Segment of Hindi Morphology in Relation to Sequencing and Prompting, Ph.D., Edu., HPU, 1975.*

The objectives of the study were : (i) to study the effectiveness of ruleg and egrul sequence with regard to the pupil response on the criterion test; (ii) to study the effectiveness of formal, thematic and mixed prompts within a sequence; (iii) to study the influence of sex with regard to the performance on the criterion test; (iv) to study the interaction of sex, sequencing and prompting; (v) to find out the interaction between sequencing and prompting; and (vi) to study the interaction between sequencing, prompting and sex taken together.

The sample consisted of 300 boys and girls drawn from three boys' and three girls' high and

higher secondary schools of Simla. The study was based on  $2 \times 3 \times 2$  factorial design. The experiment was carried out with three factors, namely, sequencing, prompting and sex differences. The following tools were administered, namely, (i) an achievement test; (ii) a criterion test; and (iii) six programme sets. Analysis of variance and t test were employed to analyse the data.

The findings were : (i) The differences between three levels of prompting were statistically not significant. The F-ratio for the interaction effects of sex  $\times$  prompting was found to be not significant. (ii) The F-ratio for the interaction effects of sex  $\times$  sequence was also found to be not significant. (iii) The interaction effect between sequence and prompting was statistically not significant. (iv) The interaction effect of sex  $\times$  prompting  $\times$  sequence was also not significant.

- \*471. *SHITOLE, C. B., To Develop Programmed Learning Material for Agricultural Subjects in Marathi Medium Secondary Schools and to Study its Utility for Different Categories of Students, Ph.D. Edu., Poona U., 1976.*

The following were the main objectives of the study : (i) to develop programmed learning material regarding a few difficult concepts from the agriculture syllabus for standard VIII of Marathi medium schools; (ii) to evaluate these programmes; (iii) to compare achievements through this programme and through the traditional methods; and (iv) to find out how effective one has been over the other.

The study adopted an experimental approach. It was conducted in Sholapur district and involved four secondary schools teaching agriculture. As many as 48 girls and 352 boys formed the sample. The experiment involved three phases, viz., construction of the programmed learning material, its administration, and its evaluation. Mean, SD, t test and analysis of variance were employed to analyse the data.

Results showed the superiority of programmed learning method over the traditional one, irrespective of the category and sex of the student. The study also showed that programmed learning method required less time than the traditional one.

472. *SINGH, B. P., An Experimental Study of Formal and Thematic Prompts in a Linear Programme in Geography on Map Reading for Class VII, Ph.D. Edu., Mee. U., 1973.*

The study aimed at examining the effectiveness of formal and thematic prompts with regard to different intelligence levels and taxonomic categories,

The specific objectives of the study were: (i) to analyse the relative effectiveness of formal and thematic prompts; (ii) to find out the effect of formal and thematic prompts at different levels of intelligence; and (iii) to find out the effect of formal and thematic prompts for different taxonomic categories. The hypotheses tested were: (i) there would be a significant difference between formal prompts treatment and thematic prompts treatment; (ii) there would be a significant difference between formal prompts treatment and thematic prompts treatment for different taxonomic categories, for the attainment at memory level, and for the attainment at understanding level; and (iii) thematic prompts would be more effective at higher level of intelligence, whereas formal prompts would be more effective at lower level of intelligence.

The sample consisted of two sections of class VII randomly drawn from the local institutions of Meerut City. The sample consisted of students with high, average and low levels of intelligence. The study was a (2 × 3 × 2) factorial design. Achievement of students was taken as dependent variable and intelligence levels and taxonomic categories as independent variables. The prompts were the primary independent variables. The reliability coefficient of the final draft of the criterion test was found to be 0.83 when computed by K-R formula. Analysis of variance and t test were used for analysing the data.

The findings revealed that (i) thematic prompts were effective as compared to formal prompts; (ii) the achievement of students having high intelligence was superior to those of average and low levels of intelligence in both the treatments; (iii) thematic prompts were more effective at high level of intelligence as well as at average level of intelligence, as compared to formal prompts; (iv) the attainment of students at understanding level in thematic prompt case was superior to that in formal prompt case; and (v) formal and thematic prompts were equally effective for the attainment at memory level.

\*473. SODHI, G. S., *Evaluation of Programmed Learning in Chemistry in Relation to Taxonomy of Educational Objectives, Intelligence and Personality Traits at the Higher Secondary Level, Ph.D. Edu., Pan. U., 1977.*

The hypotheses of the study were: (i) different modes of instruction do not account for any significant differences in respect of overall achievement in chemistry; (ii) no significant differences in achievement exist among different categories of educational objectives; (iii) no significant effect due to the interaction

between taxonomic categories of educational objectives and modes of instruction exists in respect of achievement in chemistry; (iv) intelligence is not a correlate of overall achievement and achievement in any of the categories of educational objectives; and (v) personality traits are not correlates of overall achievement in any of the categories of educational objectives.

The sample consisted of 135 grade XI science students. The programmed learning material (PLM) and criterion tests were developed for the study. The first hypothesis was tested using a factorial design. t test and product moment correlations were also used in the analysis of data.

The following were the findings of the study: (i) The PLM through branching frames was superior to lecture method in terms of total achievement and categorywise achievement of four topics; (ii) The PLM of linear style was superior to lecture method in respect of overall achievement and achievement in categories of application, analysis, synthesis and evaluation, but no significant difference was marked for knowledge and comprehension categories; (iii) Branching programme was superior to linear programme in case of total achievement and achievement in application, comprehension, analysis and evaluation categories. (iv) Branching programme was superior to lecture mode in total achievement and in all the six categories of cognitive educational objectives. (v) Intelligence facilitated achievement only on four topics. (vi) Many of the personality traits behaved as redundant variables but certain of them significantly correlated with achievement.

\*474. VERMA, G. S., *An Experimental Study of Interaction Effects of Styles of Programming, Response Mode and Taxonomic Categories in Geography, Ph.D. Edu., Mee. U., 1977.*

The major objective of the study was to ascertain the interaction effects and main effects of styles of programming, response mode and taxonomic categories.

The study was conducted on a sample of 240 students of class VIII in two cycles. The two styles of programming — linear and branching — were developed on the topic 'Earth as a Planet' in physical geography. A mixed 2 x 2 x 2 factorial design with three variables — styles of programming (A), response mode (B) and taxonomic categories (C) was used.

The major findings of the study were as follows: (i) Branching programme was more effective to linear programme. But linear programme was more

effective at knowledge level, whereas branching programme was more effective at comprehension level. (ii) The branching programme with covert response mode at comprehension level was more effective to linear programme, whereas linear programme with overt response mode at knowledge level was superior to branching programme.

\*475. VERMA, M., *The Effect of Schedules of Reinforcement and Extroversion on Programmed Instruction Achievement*, Ph.D. Edu., Meerut U., 1977.

The main objective of the study was to investigate into the interaction effect between schedules of reinforcement and extroversion dimension of personality on achievement.

A stratified sample of 81 extroverts and 81 introverts — both boys and girls of class XI in Meerut and Saharanpur cities — were selected. The Eysenck's

Personality Test adapted by Jalota and Kapoor was used to identify extroverts and introverts. The neurotics and stable boys and girls were also located on the basis of neuroticism scale scores. Programmed instructional material on Hindi 'alankar' was developed to provide three types of schedule of reinforcement, namely, continuous, intermittent (variable ratio) and no reinforcement. 3 x 2 x 2 factorial design of independent measures was employed. In the three treatments 27 extroverts and 27 introverts were assigned. The same criterion test was used as pre- and post-test. The obtained scores were analysed by employing analysis of variance and covariance techniques.

The major findings of the study were : (i) The performance of extroverts was significantly higher than that of introverts through intermittent schedule of reinforcement. (ii) The introverts learnt better than extroverts through continuous reinforcement.