# A Comparative study on effectiveness of programmed instruction and lecture method on cognitive domain of extension functionaries


## Abstract

To compare the effectiveness of Programmed Instruction (PI) and Lecture methods in bringing desirable changes in the cognitive domain of extension functionaries on the subject, 'Climate change, its impact, mitigation and adaptation strategies in agriculture', an experimental study was conducted using Solomon four group design: before-after with three controls considering 240 respondents. The mean cognitive domain scores of PI and lecture method of instruction was worked out. The results of ***t*** test revealed that there was a significant difference between effectiveness of PI and lecture methods with respect to acquisition of learning on cognitive domain.The overall cognitive domain effectiveness in PI method (45.17) was significantly higher than the lecture method (32.83). In the areas of sub-domains of the cognitive domain too, the effectiveness scores of PI method of instruction was significantly higher than the lecture method.



**Keywords:** Programmed Instruction, Frames, Lecture Method, Cognitive Domain, Extension Functionaries.




## Introduction

Lecturing is a traditional method of instruction. While, Programmed Instruction (PI) is a method of instruction in which the subject matter which is to be taught to the learners is divided into smaller units and presented in a written form in a sequence. The smaller units are called frames which contains a part of the information followed by the questions related to the information given in that frame (Michael *et al.* 1974). Skinner (1954) based on operant conditioning theory, developed PI as an educational technique. It is characterized by self paced, self administered instruction, which is presented in a logical sequence and with multiple content repetitions. He argued that, learning can be accomplished if the content is divided into small incremental steps, and if learners get immediate feedback, reinforcement and reward. In PI, the subject to be learned is arranged in a series of sequential steps, usually it moves the learner from a familiar background into a complex set of concept, principles and understanding Smith and Moore (1962). This educational technology is being extensively adopted in educating various groups such as age, sex, education, physical and mental capabilities, positions in the job, different subjects like science, mathematics, engineering, medicine, nursing, counseling. But, its utility in educating the agricultural subjects to the farming community or the extension personnel is very less. Hence, a comparative study of PI and Lecture methods in influencing the cognitive domain of extension personnel was done.

Cognitive domain deals with how we acquire, process, and use knowledge. It is the thinking domain Anderson and Krathwohl (2001). Matlin (2009) described that cognitivism refers to the unobservable change in mental knowledge and further stated that cognition meant thinking and awareness. According to Webster's dictionary (2015), cognition can be defined as

the act or process of knowing in the broadest sense; specifically, an intellectual process by which knowledge is gained from perception or ideas.

The cognitive domain according to Bloom (1956), involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major sub domains of the cognitive domain viz., (a) knowledge, (b) comprehension, (c) application, (d) analysis, (e) synthesis, and (f) evaluation starting from the simplest behaviour to the most complex.

1)Knowledge refers to the ability of learners in arranging, defining, duplicating , memorizing, naming, ordering, recognizing, relating, recalling, repeating, reproducing; 2) Comprehension refers to the ability of classifying, describing, discussing, explaining, expressing, identifying, indicating, locating, recognizing, reporting, restating, reviewing, selecting, translating; 3) Application refers to the ability of applying, choosing, demonstrating, dramatizing, employing, illustrating, interpreting, operating, practicing, scheduling, sketching, solving, using, writing; 4) Analysis refers to the ability of analyzing, appraising, calculating, categorizing, comparing, contrasting, criticizing, differentiating, discriminating, distinguishing, examining, experimenting, questioning, testing; 5) Synthesis refers to the ability of arranging, assembling, collecting, composing, constructing, creating, designing, developing, formulating, managing, organizing, planning, preparing, proposing, setting up, writing and 6) Evaluation refers to the ability of appraising, arguing, assessing, attaching, choosing, comparing, defending estimate, judging, predicting, rating, coring, selecting, supporting, valuing, evaluating. In the present investigation, a comparative analysis of effectiveness of PI over Lecture method in influencing the cognitive domain was analysed.

## Material and methods

The experimentation was done during 2013-14 in the Staff Training Unit of University of Agricultural Sciences, Bangalore. The respondents were the extension functionaries of the Dept. of Agriculture, Karnataka. Solomon four group research design was envisaged for the study. The sample size was 240 extension functionaries, in which, 120 subjects each for PI and Lecture methods (four groups of extension functionaries at 30 per group for each of PI and Lecture methods).

The developed PI material had 65 frames which was developed through linear method of programming on the subject ‘climate change, its impact, mitigation and adaptation strategies in agriculture’. The readability level of PI material was IX grade.

The stadardised scale was developed and standardized for measuring the changes in the cognitive domain. The scale consisted for 30 items at five items for each of six sub domains of cognitive domain.

During the experimentation, for administering PI material, as per the research design requirement, First, pre testing was done to two groups ($G_1$ and $G_2$). Secondly, standardized PI material was given to two groups ($G_1$ and $G_3$) to go through the material and complete the

process. As a third step, post test was conducted for all the four groups using the standardized scale.

In the same manner for administering Lecture method, First, pre testing was done to two groups ($G_1$ and $G_2$). Secondly, Lecturing was done to two groups ($G_1$ and $G_3$). As a third step, post test was conducted for all the four groups using the standardized scale.

The details of experimentation are given in Table 1.

**Table 1: Experiment to assess the effect of programmed instruction and Lecture methods**

| *Group/ batch* | *No. of respondents* | *Pre test($Y_b$)* | *Stimulus/ treatment (X)* | *Post test($Y_a$)* |
|---|---|---|---|---|
| *Experiment to assess the effect of programmed instruction* | | | | |
| $G_1$ | 30 | Yes | Programmed instruction | Yes |
| $G_2$ | 30 | Yes | No | Yes |
| $G_3$ | 30 | No | Programmed instruction | Yes |
| $G_4$ | 30 | No | No | Yes |
| *Experiment to assess the effect of lecture* | | | | |
| $G_1$ | 30 | Yes | Lecture | Yes |
| $G_2$ | 30 | Yes | No | Yes |
| $G_3$ | 30 | No | Lecture | Yes |
| $G_4$ | 30 | No | No | Yes |

The effect of stimulus /treatment (X) was worked out using the following formula.

$d_1 = (Ya–Yb)G_1 – (Ya–Yb)G_2$ (gives stimulus effect + Sensitizing effect)

$d_2 = (Ya – Yb)G_1 –(Ya – Yb)G_3$ (gives sensitizing effect)

$Z_1 = (d_1 – d_2)$ (gives stimulus effect)

$Z_2 = (Ya)G_3 – (Ya)G_4$ (gives stimulus effect)

$$\textit{Stimulus effect (X)} = \frac{Z_1 + Z_2}{2}$$

Where,

$d_1$ = difference 1
$d_2$ = difference 2
$Y_a$ = observations recorded after the treatment
$Y_b$= observations recorded before the treatment
$G_1$, $G_2$, $G_3$ and $G_4$ = 1st, 2nd, 3rd and 4th Groups respectively
$Z_1$ = Stimulus effect 1
$Z_2$ = Stimulus effect 2

The quantification of effectiveness of stimulus on cognitive domain was worked out using the following formula.

$$ECD = \sum_{n=1}^{5} \frac{AKS}{PKS} X100 + \sum_{n=1}^{5} \frac{ACS}{PCS} X100 + \sum_{n=1}^{5} \frac{AApS}{PApS} X100 + \sum_{n=1}^{5} \frac{AAnS}{PAnS} X100 + \sum_{n=1}^{5} \frac{ASS}{PSS} X100 + \sum_{n=1}^{5} \frac{AES}{PES} X100$$

Where,

ECD = Effectiveness of stimulus on cognitive domain
AKS = Actual knowledge score
PKS = Possible knowledge score
ACS = Actual comprehension score
PCS = Possible comprehension score
AApS =Actual application score
PApS =Possible application score
AAnS = Actual analysis score
PAnS = Possible analysis score
ASS = Actual synthesis score
PSS = Possible synthesis score
AES = Actual evaluation score
PES = Possible evaluation score

## Results and Discussion

The mean cognitive domain scores of PI and Lecture methods of instruction are furnished in table 2. The results of ***t*** test revealed that there was a significant difference between effectiveness of PI and lecture methods with respect to acquisition of learning on cognitive domain. The results further revealed that, overall cognitive domain effectiveness in PI method (45.17) was significantly higher than the lecture method (32.83). In the areas of sub-domains of the cognitive domain too, the effectiveness scores of PI method of instruction was significantly higher than the lecture method. Figure 1 illustrated the same.

**Table 2: Comparison of effectiveness of PI and lecture methods on cognitive domain of extension functionaries**

(n=240)

| ***Sl. No.*** | ***Sub- domain/ domain*** | ***Effectiveness scores*** | | ***P (T ≤ t)*** | ***t value*** |
|---|---|---|---|---|---|
| | | ***PI*** | ***Lecture*** | | |
| 1 | Knowledge | 47.83 | 32.33 | 0.0001 | 4.14 ** |
| 2 | Comprehension | 38.50 | 25.67 | 0.004845 | 2.93 ** |
| 3 | Application | 37.17 | 29.67 | 0.031965 | 2.20 ** |

| | | | | | |
|---|---|---|---|---|---|
| 4 | Analysis | 47.00 | 36.33 | 0.023647 | 2.32 ** |
| 5 | Synthesis | 48.17 | 35.83 | 0.003344 | 3.06 ** |
| 6 | Evaluation | 52.33 | 37.17 | 0.004638 | 2.95 ** |
| | **Overall cognitive domain** | **45.17** | **32.83** | **0.001** | **6.44 ** ** |

** *Significant at 1 per cent level*

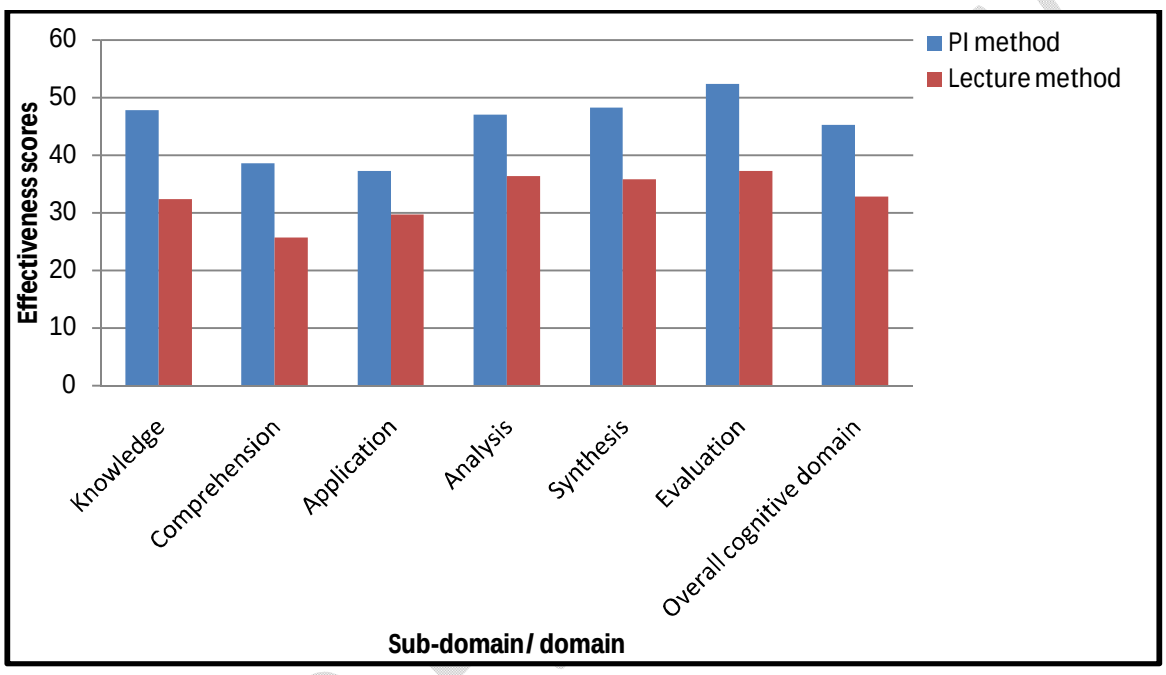


***Fig. 1: Effectiveness of PI and lecture methods on cognitive domain of extension functionaries***

The PI has unique instructional qualities like (a) ensures active participation of the learner by way of answering questions provided in each frame, (b)ensures repeated reading by learner till the contents are perfectly understood before answering the questions, (c) reinforcement on learners occurs twice by answering question/s and cross checking with the correct answer, (d) creates curiosity among the learners leading to enthusiasm to readers till the end of the event, (e) reader can refer back to the information whenever s/he feels so at any point of time, (f) learners feel different learning experience due to avoidance of monotony, (f) provides complete information on the topic and logical sequencing of subject. These attributes of PI will maximise the learners' acquisition of technology at different stages of cognitive domain. All these qualities may not be found in conventional method, lecture. The findings of Venugopal (1975) support the findings of this study. He has observed in his study that the PI was superior to lecture method in acquiring and retaining agricultural technology by educated farmers and high school children.

There were some studies available to indicate the influence of PI over other instructional methods on overall performance of different categories of learners. The findings of Kulik *et. al.*

(1974), Crabb *et. al.* (1983), Goldrick (1989), Miller (1998), and Izzet *et al.* (2006) revealed that PI was superior to lecture method in acquisition of knowledge. An interesting finding by Uhumuavbi and Mamudu (2009) revealed that PI was superior to demonstration method.

## Summary and Conclusion

The comparison of PI and Lecture methods clearly illustrated that PI is superior over Lecture method and has significant effect on the cognitive domain of extension functionaries on the subject - climate change, its impact, mitigation and adaptation strategies in agriculture. Further, PI was found to be effective at all the sub-domains of cognitive domains in acquiring new technology.Therefore, the PI material can be best utilised to educate extension functionaries on the new agricultural technologies emerging from time to time. PI can also be used for modifying the intellectual abilities and skills of the literate farmers on new agricultural technologies like protected cultivation, secondary agriculture *etc*., which intern drive them towards adoption of these technologies.

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