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Evaluating the Perceptions of Primary School Teachers' regarding SOLO Taxonomy

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Abstract

In 2006, the Government of the Punjab Province has reformed the examination system of primary and elementary level according to the SOLO taxonomy. The aims of this research paper is to find out the conceptual awareness of primary teachers regarding SOLO taxonomy and to analyze the knowledge of primary teachers regarding the different levels of SOLO taxonomy. The design of the research was descriptive. All the Primary School Teachers of Attock were the population of the study and four hundred (400) primary teachers were taken randomly as a sample. A validated research instrument was used for data collection. The data were analyzed through percentage. The major findings showed that majority of the teachers did not give right answers regarding the statement that creative thinking is examined in the level and majority of the teachers gave right answers regarding the statement that relationship between different aspects is examined in the level. At the end of the study, it was recommended by the researcher that training sessions related to SOLO taxonomy may be arranged for the primary teachers in the summer vacations and SOLO taxonomy based model papers may be provided to the primary teachers in the beginning of the academic year.

Key Words: *SOLO, Primary, Teachers, Examination, Perception.*

Introduction

Basic component of an educational system is the evaluation. Evaluation by examination provoke hard working habits to compete the other fellows. The creation of competitive atmosphere is a salient feature of an effective examination system (Umbreen, 2008). The promotion of capable students to the next level of their study programs is one of the important functions of an evaluation system. It must assess the students whether they have attained the desire level of information, skill and attitude. The concept of examination was introduced to find the effectiveness of the teaching, to judge the talent of the students so that they could win the fame in public debates. In modern scientific era the examination works like a tool to prove one's talent and get appreciation from the society (Mascarenhas, 1991). Aggarwal (1997) noted some more ends for a written or oral examination to serve which the assessment of intellectual faculty, measurement of student progress are during and after the instructional course, promotion to next

grade and award of scholarship. The examination system of elementary level in Pakistan promote rote learning and measures the reproduction of the text content. It only provides criteria to entitle students passed or failed but it is not an index of the achieved skills of respective level. The current examination system has failed to improve educational standard. The current situation of examination in Pakistan demands major reforms in it to improve the quality of education. The reforms in examination would open a new line thinking for learning for natives of this country and generate new opportunities. The improvement of the examination is inevitable for raising educational standards. The new examination system is based on SOLO taxonomy of Biggs & Collis (1982). The government the Punjab has arranged many training sessions to comprehend this new system before its implementation. Initially, it was planned to implement SOLO at grade five level. Thus, all functionaries were equipped for it implementation. In 2006, the Government of the Punjab Province has reformed the examination system of primary and elementary level according to the SOLO taxonomy. The SOLO taxonomy is being applied developed countries for example Australia to improve the quality of education. The researchers showed that it is a successful practice. In SOLO taxonomy there are five stages namely, pre-structural, uni-structural, multi-structural, relational and extended abstract. The SOLO taxonomy reflected in it all gradual findings of the research work of (Biggs & Collis, 1982, 1989, 1991). The latest version of SOLO taxonomy is based on structural complexity of the performance of students. The old construct of stage was modified by construct of mode in later version of SOLO taxonomy. (www.solotaxonomy.com)

As the assessment process is the most important phenomenon in educational set ups so the researchers started research on SOLO system to highlight its merits and demerits. It was done to encounter the harmful consequents for educational system in Pakistan. In the light of careful research work the Government of the Punjab has decided to replace Bloom's taxonomy with SOLO in 2005. Initially, it was implemented on classes V and VIII. There are many research works found in the world both critique and analysis of it advantages. In Pakistan, there is less trend to analyze the SOLO taxonomy. This gap of study has convinced the researcher to investigate the problem (Reilly, 1990).

Statement of the Problem

The study was designed to evaluate the perception of primary school teachers regarding SOLO Taxonomy in Attock.

Objectives of the Study

The chief objectives of the study were:

1. To find out the conceptual awareness of primary teachers regarding SOLO taxonomy.
2. To analyze the knowledge of primary teachers regarding the different levels of SOLO taxonomy.
3. To suggest suitable measures for the improvement of the new examination system.

Review of Related Literature

Bloom's taxonomy of objectives was proposed by Benjamin Bloom in the University of Chicago in 1965. It divided the objectives into three hierarchal domains of cognitive, affective and psychomotor. Orlich, (2004) clarified the hierarchal nature of domains that higher domain of objectives can be achieved by getting mastery in lower domains. Now in Pakistan Bloom's taxonomy is replaced by a new SOLO taxonomy.

SOLO Taxonomy

SOLO stands for structure of observed learning outcomes. It is a mean of classifying learning outcomes in terms of their complexity. SOLO was put forth by John Biggs and Kevin Collis in 1982. They were Australia educationists and they have developed a mechanism for assessment of student work in terms its quality (www.solotaxonomy.com). The SOLO has significant applications both in assessment and curriculum development. The curriculum is regarded as a set of parameters that defined the intended development of the students in terms of their development in skills and attitudes. The curriculum is a document that addresses the matters of aims of particular level of education, content to be taught, methods of teaching and the evaluation techniques. The SOLO taxonomy addresses all above said matters effectively. The selection of aims and goals for educational set up is the main function of curriculum. The evaluation system is meant for the determination of achievement of intended standards of knowledge, attitude and skills. The role of evaluation as a component of curriculum is:

- To measure the achievement of the intended general objectives.
- To measure the achievement of the intended specific objectives.
- To diagnose the problems of the students
- To judge the effectiveness of the teachers and their teaching strategies
- To prepare recommendations for educational management for revision of curriculum (Orlich, 2004).

The evaluation system in Pakistan is not serving the ends mentioned in above lines. The Prevailing evaluation system test just memorization reproduction power of the students and entitled them passed or failed. It is not devised to measure higher competencies like attitudes and psychomotor skills. Thus, it is no more helpful for improving educational standards in Pakistan. The failure of present evaluation system directs towards the need of a new evaluation system which fulfil task of raise of quality of education (www.solotaxonomy.com).

SOLO Hierarchy of Outcomes

Cognitive view of learning suggested four developmental stages, but the SOLO divided the outcomes into five stages. Biggs and Collis (1982) believed in post-formal mode of cognitive development which is beyond the normal cognitive development found in students in a school. However, it differs from that of Piaget in having hierarchal nature. Piaget's stages were mutually exclusive but SOLO proposed hierarchal modes of development of cognition. Biggs &Collis (1991,) argued that "modes accrue from birth to maturity" and the successive stages have clear difference line for identification of construct of student performance to compare it with target performance level. Availability of mode eventually turn into a multi modal performance norm. The five mode are discussed below:

1. Sensory Motor Mode: it is based on nature of physical environment of a student. The students construct their abilities by interacting coordinating with physical surrounding. Sustained development is achieved by supporting skills to get comprehensive knowledge
2. Iconic mode: It is the second way of expressing outcomes by imaginary symbols to show sensorimotor elements of learning. These symbols work as the part of this mode and are used for verbal communication. The intuition is a reoccurring of unique thoughts is applied to develop symbols working as icons of outcomes (Flavell, 1963). The features of this mode included wise guessing, manipulation of existing situations and graphical presentation of thoughts in the minds. This is quite natural to employ iconic mode using concrete symbols which is the most important mile stone of school education.

3. Concrete symbolic mode: in this mode abstract things are replaced by physical and concrete things for instance oral advices are replaced by written statements and symbols during teaching experiences in the world (Biggs & Collis 1991). The symbols are logically related with the physical environment and are effectively applied in fields like Mathematics, Music and alphabets of languages. This mode required in detail procedural guideline for its implementation to gain its mastery. It is a target mode for mathematics in a school where active use of environment is attempted. Symbolic patterns are used to teach algebra to find the teaching experience in concrete form which used description of languages. It is way of developing more to the point notations of the descriptions. It is different from iconic mode where abstract things are expressed in symbolic notations with no reference to real world situation around the student's perspective and resulted rote learning in students. This type activities are more suitable for children working in formal mode of learning and teaching.

In these modes the forms of knowledge with respect to the ages of students is presented in the Fig. 1

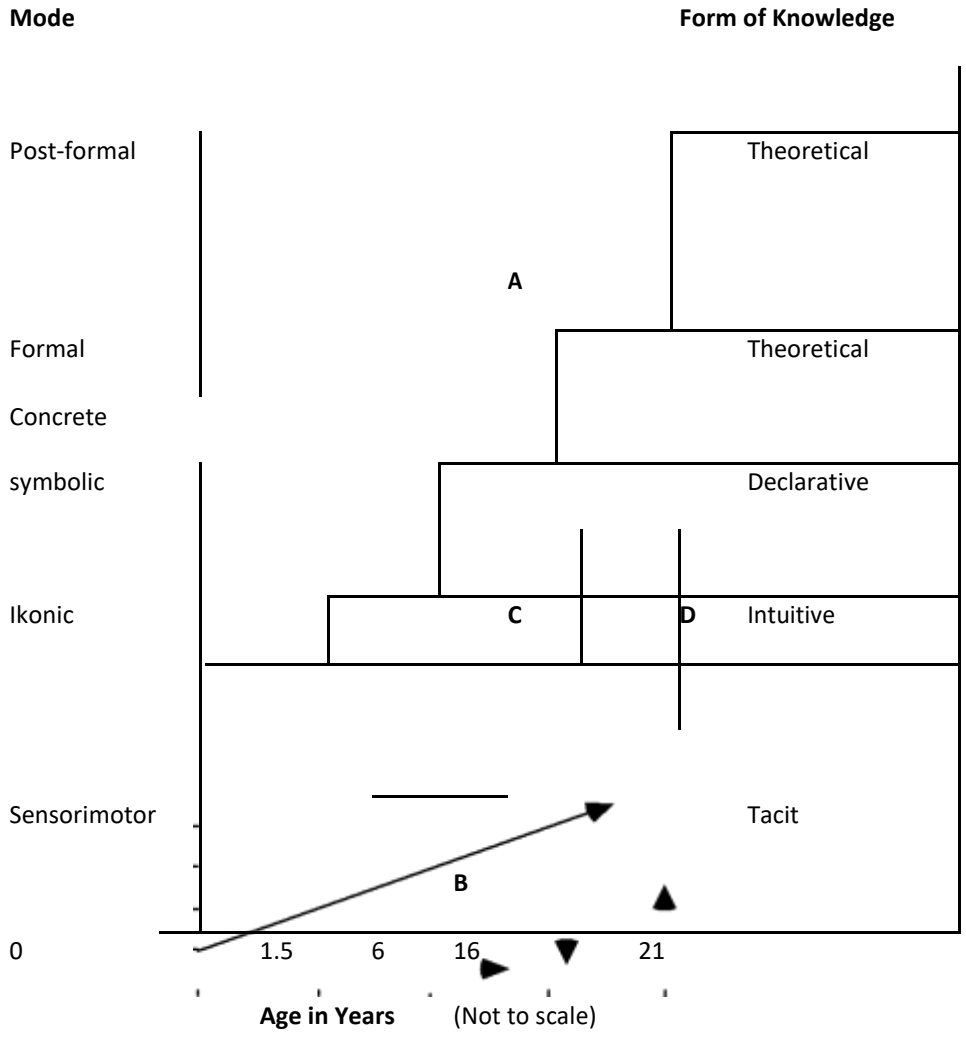

Fig 1: Modes and Forms of Knowledge (Adapted from Biggs and Collins (1991)

4. Formal mode: It is stated in above lines that the components of focus point in formal mode are theoretical variables without real existence. It used the formation of hypothesis from observation and back ground knowledge logical reasoning such as induction and deduction. Biggs and Collis (1991) have a view that formal mode is suitable for bachelor degree programs because student at this stage are able enough to work proper in this discipline.
5. Post-formal mode: it is not supported by research studies, so it is mere based on hypotheses. This mode enables students to raise questions about the basic tenets of the respective field of study.

Some Important aspects of SOLO Taxonomy

The SOLO was developed as a tool of instruction and assessment to facilitate a teacher. Biggs and Collis (1982) used it to develop curriculum of English, Mathematics, second languages, history and geography. This practice continuously used for natural science subjects to develop instructional design for that subjects (Levins, 1992).

SOLO is applied in various fields of Mathematics and for different age group students to analyze their cognitive outcomes. The ability in fractions of arithmetic's of the age groups of K_1 to K_{10} students is evaluated by applying SOLO (Campbell, 1992). Watson and Mulligan (1990) argued that SOLO taxonomy is applicable for evaluating multiplication for age group of K to 3. In geometry it is applicable for age groups K5 to K8 (Davey & Pegg, 1995) but Woolley (1994) has different point of view than that of others as they consider SOLO is applicable in evaluation of geometry and algebra for age group K10 to K12. Mortiz and Watson (1994) recommended its application in subject of Statistics for years 3 to 9, problem solving in year 9 to 10 and measure of volume of prisms 2 to 6 (Campbell, Watson & Collis 1992).

This model is effective in analyzing students' rational phenomena that is visible and classifiable even in the presence of unknow influential factors. The proponent of constructivism argued that these explanations of human behavior are so simple its authenticity is questioned by Reilly (1990) especially identification of some pathway through mathematics. The educationist Hart' (1981) has objected the assumptions of this methodology in his book "Concepts in Primary Mathematics and Science Research Project (CSMS). Reilly (1990) noted that the project assumed that understanding of math concept is hierarchal and to find the hierarchies was the aim of the study. The criticism on it is with understanding the context of the study. Thus, the assumptions are explicit and could be viewed in the light of circumstances of this study

Use of SOLO in Examinations

SOLO was started to be used in examination to ensure the quality of measurements because it is successfully applied in many developed countries for example Australia.

Salient Feature of SOLO

- It promotes meaningful learning and minimize rote learning.
- It ensured progress of students by passing all levels of learning in all tasks.
- It assists the students to identify the sequential steps to comprehend the things.
- It employs open ended questions and guide properly in class room instructional activities.
- It directs towards the scope and framework of the curriculum.
- It provides clear instruction to establish content validity of test used in examinations.
- It has clear analytical power to explain competencies of different groups of the students (Courtney, 1996).

Rationale to Use SOLO

As SOLO explains the learning outcome in hierarchal fashion, it is suitable for enhancing quality of educational thoughts. It is a powerful tool for labor division in the curriculum and put the students into meaningful learning challenges. It provide the best facility to achieve a balance between cognitive demands of the problems and to provide proper procedural guideline to complete the activities and tasks. Thus, it is helpful to activate metacognitive thinking processes in students. It facilitates the development of deeper thinking without generating new initial stages of unstructured and multi-structural. (UNICEF, 2005).

Effect of SOLO on the Quality of Examination

In the light of discussion on SOLO in above pages showed that the essential features of a question paper are:

- Items must have validity with respect to the concepts and competencies intended to be measured.
- Test must be reliable and show same result in repeated attempts of measurement
- It should cover variety of student abilities.
- It should allow students to express their knowledge freely.

SOLO Taxonomy in Pakistan's Perspective

The Government of the Punjab has established testing institution for elementary levels named Punjab Examination Commission at Lahore. The aim of PEC was to measure SLOs of the students of classes 5 and 8 in the light of framework suggested by SOLO. The ultimate goal was to develop PEC as a center of excellence by applying latest measuring techniques and technologies found in developed countries. It was so developed to act as beacon house for all other professional and administrative institutions in the bureau of Punjab education. This aim of PEC is not mere a political statement made without originality, but it shows commitment of the Government of the Punjab enhance the quality of education in the province. This commitment of the government to reform examination system for better quality of education is actually the realization of inevitable role of examination in an educational system. The establishment of centers of excellence is a great task and take time to be functional. It requires long term planning and sustained policy and input efforts to achieve the objective of development of such center of excellence. Thus the road map of PEC is quite practical and should be monitored and evaluated carefully with respect to its goals (Standridge, 1990).

Performance of PEC in last five years is given below to visualize its successfulness in achieving its objectives

- In years 2006, 2007, the examination of classes 5 and 8 was conducted with new technique based on SOLO taxonomy of outcomes for registered public school and private schools.
- In 2008, the PEC was given independent status by passing necessary legislations.
- In 2009, PEC has conducted examinations of classes 5 and 8 with the collaboration of UNICEF to incorporate international standards in the examination system of school education department of the Punjab.
- In 2010, PEC extended its sphere of influence to all private and public schools to provide it services and products. These services and products include variety of assessment techniques that are equivalent to ordinary and advance levels of Cambridge (www.pec.edu.pk).

Features of Examination Papers Based on SOLO Taxonomy Developed by PEC

PEC has developed test items by deploying teams of experts to incorporate principles of SOLO. It was done for the class 5 for the subjects of English, Urdu, Social Science, Islamic Studies, Science and Mathematics. These question papers have following characteristics:

- They measure comprehension and higher abilities.
- They measure competencies of the students according to the objectives of the curriculum.
- The question paper consists of MCQs and open-ended questions.
- There is no choice given in these papers and the students have respond all items of the questions paper.
- These question papers allow students to write their answers on the space provided in the paper only.
- Marking of these question papers is done according the rubrics provided by PEC. There is no negative marking.

The aim of PEC was to improve the examination system at elementary level in the Punjab. The Government has allotted following tasks to PEC given as under:

- Improve teaching and learning to achieve comprehension of the concepts of the topics in syllabus
- Monitoring the services and the whole elementary education.
- Provide required facilities to achieve goals of education.
- Preserving equity right of the students of urban and rural areas.
- Guide teacher to promote students from lower to higher classes.
- Quality assurance in the conduct of examinations (Levins, 1992).

Marking Scheme of SOLO Taxonomy, its Need and Usefulness

When a question paper is prepared for examination, its marking scheme is also developed at the same time. When a marker is given papers to mark, marking scheme is also provided to her/him. Its purpose is to facilitate the marker with her/his work and to provide necessary material to ensure that the marking is fair. Punjab examination commission has introduced rubrics of papers first time in the history of education in Punjab. The rubrics are guidelines for examiners to evaluate the papers in the same pattern throughout the province. It is a strategy to achieve fair marking goal.

What is a Marking Scheme?

The marking scheme is called the rubrics. It is a document containing model answers, division of scores. Rubrics is a document that inform examiners:

- Directions about maximum marks.
- Division of marks for each part and sub-parts of the questions.
- Model answer to each question.
- Directions about the correct acceptable response;
- Possible wrong attempts.
- Directions to ward maximum credit.
- How to award partially correct responses.
- How to score graphical presentations in the paper (Campbell, 1992).

The Need and Usefulness of Marking Scheme

- Rubrics provide in detail guideline to examiners to perform. Therefore, their duty to award correct weightage to the student response easily with accuracy.
- Fair marking become possible Because of the detailed instructions.
- The bias of the examiners is minimum because of correct model answer is given in the rubrics.
- This rubrics system permits only objective marking
- The rubrics enables the examiners to award marks according to ability of the students.
- The marks allocated in the Marking Scheme for each question and parts are also written on the question paper. This lets the students know how much detail and time a question requires. It is pertinent to mention that marking for MCQs will be done on computer software. The markers will be assigned the work to mark the short answer / Open – ended questions for which they are being trained. (Yanik, 2006).

Research Methodology

The purpose of this research was to find out the conceptual awareness of primary teachers regarding SOLO taxonomy and to analyze the knowledge of primary teachers regarding the different levels of SOLO taxonomy. The design of the study was descriptive in nature for judging the perception of primary teachers regarding SOLO taxonomy. The target population of the study was comprised of all the primary teachers of government educational institutions who were teaching at grade five students in District Attock. Sample is a subset of the whole population which represents the whole population. In this study (400) primary school teachers of public sector primary schools were taken as a sample through random sampling technique. A validated questionnaire was used for data collection in this study which was consisted on 15 statements. In the beginning, the data collection tool (Questionnaire) was consisted of 25 statements. After validating by taking expert opinions, 10 statements were deleted from the questionnaire and it was pre-tested for reliability. Before the process of data collection, the researcher obtained institutional support letter. The researcher also got permission letter from the Dupty D.E.Os' of Attock in order to get cooperation from teachers of different schools .The data were collected personally through visits and E-mail. After collection of data, it was tabulated, scored, analyzed and interpreted.

Analysis of Data

Table 1: Analysis of data

S.No.	Statements	Frequency of Right Responses	Percentage	Frequency of Wrong Responses	Percentage
1	SOLO stands for:	142	35.5 %	258	64.5%
2	SOLO was presented by:	135	33.75%	265	66.25%
3	PEC Examination is based on which taxonomy:	160	40%	240	60%
4	SOLO is presented in:	154	38.5%	246	61.5%
5	SOLO has domains:	132	33%	268	67%
6	Surface domain of SOLO is consisted on levels:	250	62.5%	150	37.5%
7	Deep domain of SOLO is consisted on how many	260	65%	140	35%

	levels:				
8	One aspect of a task is understood in the level:	256	64%	144	36%
9	Two or more aspects are understood in the level:	270	67.5%	130	32.5%
10	Integration is developed between two or more aspects in the level:	149	37.25	251	62.75
11	No understanding belongs to the level:	283	70.75%	117	29.25%
12	To go beyond the given information is related to the level:	275	68.75%	125	31.25%
13	Multi-structural is considered in:	290	72.5%	110	27.5%
14	Creative thinking is examined in the level:	151	37.75%	249	62.25%
15	Relationship between different aspects is examined in the level:	270	67.5%	130	32.5%

Interpretation of the data

Table 1 row 1 showed that only 35.5% of the primary teachers gave right answers while 64.5% of the primary teachers gave wrong answers regarding the statement that SOLO stands for Structure of Observed Learning Outcomes.

Table 1 row 2 showed that only 33.75% of the primary teachers gave right answers while 66.25%of the primary teachers gave wrong answers regarding the statement that SOLO was presented by Biggs and Collies.

Table 1 row 3 showed that only 40% of the primary teachers gave right answers while 60% of the primary teachers gave wrong answers regarding the statement that PEC Examination is based on SOLO taxonomy. Table 1 row 4 showed that only 38.5% of the primary teachers gave right answers while 61.5% of the primary teachers gave wrong answers regarding the statement that SOLO is presented in 1982.

Table 1 row 5 showed that only 33%of the primary teachers gave right answers while 67% of the primary teachers gave wrong answers regarding the statement that SOLO has domains. Table 1 row 6 showed that only 62.5% of the primary teachers gave right answers while 37.5% of the primary teachers gave wrong answers regarding the statement that Surface domain of SOLO is consisted on levels.

Table 1 row 7 showed that only 65% of the primary teachers gave right answers while 35% of the primary teachers gave wrong answers regarding the statement that Deep domain of SOLO is consisted on how many levels.

Table 1 row 8 showed that only 64% of the primary teachers gave right answers while 36% of the primary teachers gave wrong answers regarding the statement that one aspect of a task is understood in the level. Table 1 row 9 showed that only 67.5% of the primary teachers gave right answers while 32.5% of the

primary teachers gave wrong answers regarding the statement that two or more aspects are understood in the level.
Table 1 row 10 showed that only 37.25% of the primary teachers gave right answers while 62.75% of the primary teachers gave wrong answers regarding the statement that Integration is developed between two or more aspects in the level.

Table 1 row 11 showed that only 70.75% of the primary teachers gave right answers while 29.25% of the primary teachers gave wrong answers regarding the statement that no understanding belongs to the level.

Table 1 row 12 showed that only 68.75% of the primary teachers gave right answers while 31.25% of the primary teachers gave wrong answers regarding the statement that to go beyond the given information is related to the level.

Table 1 row 13 showed that only 72.5% of the primary teachers gave right answers while 27.5% of the primary teachers gave wrong answers regarding the statement that Multi-structural is considered. Table 1 row 14 showed that only 37.75% of the primary teachers gave right answers while 62.25% of the primary teachers gave wrong answers regarding the statement that Creative thinking is examined in the level.

Table 1 row 15 showed that only 67.5% of the primary teachers gave right answers while 32.5% of the primary teachers gave wrong answers regarding the statement that relationship between different aspects is examined in the level.

Conclusion

On the basis of findings, the conclusion were drawn that majority of the primary teachers were not awared regarding the statements that SOLO stands for structured of observed learning outcomes, SOLO is presented by Biggs &Collies, PEC examination is based on SOLO taxonomy, SOLO has two domains, Integration is developed between two or more aspects in relational level, creative thinking is examined in the extended abstract level. Majority of the primary teachers gave the right answers of the following statements that surface and deep domain of SOLO are consisted on how many levels, one aspect of a task is understood in the uni-structural level, two or more aspects are understood in multi-structural level, no understanding belongs to pre-structural level, to go beyond the given information is related to the level and relationship between different aspects is examined in relational level of SOLO.

Recommendations

On the basis of findings and conclusion, the following recommendations were suggested

1. Training sessions related to SOLO taxonomy may be arranged for the primary teachers in the summer vacations.
2. SOLO taxonomy based model papers may be provided to the primary teachers in the beginning of the academic year.
3. Policy makers of curriculum may provide the SOLO based content materials to the teachers for effective teaching.
4. All the teachers may be awarded about the marking scheme of SOLO manual so that they may be able to teach effectively.

5. Punjab Examination Commission may conduct seminars, workshops and lectures by the experts of SOLO Taxonomy for teachers.

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