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"Importance of Single National Primary Level Science Curriculum (2021) in the Development of Students' 21st Century Skills by Using Bloom's Taxonomy: A Literature Review"

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ABSTRACT

It has mentioned in the National Educational Policy (2017) that standard of quality in education at Primary level in the Public Schools of Pakistan is very low because teachers are less experienced, used outdated teaching methods and having low level dedication to their work, curriculum is not according to the age level of students and plays a minimum role in developing problem-solving skills in students, teaching-learning resources are not available in number, content of textbooks is focused on passive and rote learning, and assessment practices are also fruitless (National Education Policy, 2017). So at present, the Government of Pakistan (March 2021) has taken the decision to implement the SNC at primary level and the purpose of this curriculum is to bring quality of education in the curriculum, teaching and assessment practices. Purpose of this study is to provide relevant literature whether SNC 2021 helps in developing higher order thinking skills such as critical thinking, problem-solving abilities and creative abilities in primary level students because development of higher order thinking skills is the demand of 21st century. The present study also aims to depict the importance of Primary School Single National Science curriculum in the development of students' 21st Century Skills by using Bloom Taxonomy.

Introduction

Science provides facts based information by using scientific methods and develops problem solving abilities in students. Science is based on two elements and one is related to knowledge of science and the other is related to obtaining knowledge through different teaching methods of science (Ozgelen, 2012). Process of teaching science in schools is based on three components that are content, teaching methods and environment. Content is based on all the learning concepts, teaching methods include the techniques by which content is delivered to students and environment is related to use of learned knowledge practically for solving the problems (Childs, 2015). Subject of science is taught as compulsory subject at primary level and the basic purpose of teaching science is to provide information about natural world and its surroundings (Iqbal & Mahmood, 2000). Higher order thinking skills are learned to students through their teaching content and teaching methods so curriculum of science has to enrich with the higher order thinking skills so that students can face the challenges of employment and spend a successful life (Sahito, 2019). Higher order thinking skills provide the base to get expertise of 21st century skills and necessary to survive in the competitive environment. For this purpose, planned changes have to bring in the education system. It requires the training of teachers as well as brings changes in the curriculum to meet the quality standards because curriculum of any class plays a role like action plan and provides guidelines about all the aspects of teaching-learning process (Hassan et al., 2017). So education plays an important role in the socio-economic development of individuals and it may be obtained from different sources that are formal, informal and non-formal system of education. Formal education is obtained through different types of institutes that are English medium schools (Offering Oxford and Cambridge) and Public schools. Their curriculum objectives, content, teaching techniques and assessment system varies from system to system. Single National Curriculum of science is going to be implemented in the new academic session (March, 2021) in all the school systems and its purpose is to develop critical thinking skills in students in aspect of Bloom's taxonomy.

Concept of Science

Science follows a systematic process to provide information about those particulars that are existed in the universe by following scientific methods such as observation and experimentation. Science plays an important role in different fields of life:

1. Science introduces new methods, ways and medicines to provide safety measures to plants, animals and human beings and these are based on scientific methods.

2. Students may obtain knowledge about different fields of science by introducing new fields of science. This refers to the innovations and progress of science.

Science has great importance in the curriculum of science due to the following reasons:

1. Science develops scientific attitudes in students and it enables the individuals to solve daily life problems by applying scientific methods.

2. Scientific knowledge increases the aesthetic sense of students and it helps in searching the reality of natural world.

3. Science develops logical thinking skills in students and these facilitate the

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individuals to know about their environment (Pattnaik et al., 2012).

Concept of Curriculum

The word curriculum is derived from the Latin word which means to run. In etymological term, curriculum is based on sets of learning activities and students have to complete these decided activities in a given time period. Curriculum is comprised of different concepts:

1. Curriculum is combination of different subjects which are taught at different levels of education and students have to get expertise in the content of different subjects. 2. Curriculum includes designed teaching activities and these are teaching techniques, teaching methods, learning resources guides, session plans and evaluation methods. These designed activities facilitate in meeting the learning needs of students. 3. Curriculum is a set of instructional objectives and these objectives have to be clearly defined. In formulating these objectives, new version of cognitive domain of Bloom's taxonomy has to be used (Yeung, 2012). Course outlines and scheme of studies are also the part of curriculum but course outlines are the details of taught courses and scheme of studies are about practical aspects for teaching content to students (Ashraf et al., 2011). Main features of Curriculum are:

1. Focuses on development of all aspects of students' personality that is physical, social, emotional, psychological, and ethical. 2. Linking of previous learning experiences to the present experiences. 3. Knowledge about educational objectives, content and learning activities. 4. Equal importance to all learning objectives (Hussain et al., 2011).

Types of Curriculum

1. Suggested Curriculum

It is suggested by beneficiaries of education system who have the expertise in the relevant field and have professional knowledge. It is detailed description of the development process of curriculum and learning aspects of curriculum.

2. Structured Curriculum

It is also called written curriculum and provides the detail of teaching learning process in aspect of selection of teaching methods and learning activities for students.

3. Supported Curriculum

It describes the types of resources for implementing the planned curriculum and both human and material resources are described. Human resources provide guidelines about qualification of teachers and availability of desired number of teachers. Material resources are about number of classrooms, furniture and teaching aids.

4. Implemented Curriculum

It describes the role of teachers because they are the implementers of curriculum. Teachers understand the actual situation of schools in aspect of students' needs, individuals' variations and available resources. Due to these reasons, teachers can bring changes in the implementation process of curriculum and curriculum specialists give freedom to teachers to bring changes in the implementation process of curriculum.

5. Learner-Centered Curriculum

It explains about the desired changes that have to bring in students' behavior by teaching content of different subjects.

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6. Evaluated Curriculum

It describes types of evaluation that have to be used for evaluating the students' learning. It evaluates the learning level of students that have been happened through the learning of structured curriculum.

7. Hidden Curriculum

It is not in prescribed form and details of unanticipated behaviors of teachers and schools that have impacted on students. (Nosheen, Jabbar, Awan, 2018)

Curriculum Development Process in Pakistan

Curriculum wing that is ministry of education decides to bring changes in the implemented curriculum and forwards suggestions to the Centers of Provinces. These centers bring changes in curriculum according to desired requirements of curriculum wing. Centers of provinces are comprised of different types of committees and the members of these have knowledge of relevant field and teaching methods. Initial plan of curriculum is forwarded to curriculum wing for finalization. Ministry of education forwards the initial plan of curriculum to National Committee for revision. Final curriculum is sent to Federal for finalization and textbook board for publishing of textbooks (Ashraf et al., 2011).

Approaches of Science Curriculum

1. Discipline Based Approach

2. Integrated Approach

1. Discipline Based Approach

Knowledge of different subjects is conveyed to students by teaching each subject separately and content of subject has value than the process. It is teacher-oriented approach and teacher decides about the delivery of content. It requires those teachers who have expertise in their relevant field and does not develop the innovative abilities in students.

2. Integrated Approach

It is students-oriented and describes the relationship between the learned concepts of different subjects. Role of teacher is facilitator because students obtained the knowledge by using explorative methods. Teachers solve these problems in which they face difficulty, new methods of teaching are used and focuses on developing logical thinking skills in students. Types of integrated approach are:

4. Integration between within the subject

Students solve their problems of one subject by taking help from the knowledge of another subject.

2. Integration among different subjects

Students will not solve their problem by taking help from different subjects but they discuss different dimensions of the problem. (Pattnaik et al., 2012)

Situation of Science in Schools of Pakistan

In Pakistan, education system is divided into different levels of education. These are elementary, secondary and tertiary systems. Elementary is divided into two levels: one is related to primary and second is related to middle level education. Secondary education is divided into secondary and higher secondary education. Tertiary education includes college and university level education. Science at elementary level includes the

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knowledge about physics, chemistry, and environmental science. 12% time has to be allocated for teaching of science at primary level and 13-15% time for middle level science teaching. The basic objective of teaching science at elementary level is to provide knowledge about natural world. For this purpose, appropriate number of science teachers is necessary with having sufficient knowledge of science and using learning resources for teaching science (Iqbal & Mahmood, 2000).

According to National Education Policy (1992), quality of education is not meeting its objectives and going to downfall specifically in the subjects of science, languages and math. In new educational policy, following steps have been initiated to improve the quality of teaching in schools:

Curriculum

Curriculum will be based on problem-solving questions and these skills will be developed by assigning projects to students. Occupational learning will be based on the challenging job requirements and meet the present needs of students. Curriculum of science will be revised to provide updated knowledge to students. Repetition of topics in the content of science will be finished.

2. Textbooks

Curriculum enlargement and content of book will be harmonized. Motivational benefits will be provided to teachers who will use the new teaching methods and resources for teaching. Lot of textbooks will be prepared for courses and it will be the choice of educational institutions to use the relevant book. Teachers will be motivated to use the sources of library for performing different assigned tasks.

3. Teachers

These steps will be decided to teachers' training such as establishment of teachers training institutions, moveable units for training of new teachers, remove the weaknesses in the science teachers, and strengthened of science curriculum.

4. Material Resources

Material resources like computer labs, science laboratories and new teaching aids for teaching of science will be introduced in schools.

5. Assessment

Internal evaluation in the final exams will be used by teachers.

Curriculum Evaluation

Evaluation of curriculum involves the procedures for evaluating the strengths and weaknesses of the implemented curriculum and evaluation includes the evaluation of learning objectives, teaching methods and assessment papers. Two models of curriculum evaluation are used: one is focused on using the objectives for evaluation and the other is focusing on not using objectives for evaluation. First one is related to describe the worth of prescribed curriculum in successful achieving of the desired objectives, used different techniques for evaluation of the curriculum, and recommended the steps of scientific process for evaluation of curriculum and the consequences may be implemented in different situations. Second is related to process of curriculum development, evaluation of learning activities, amendments in curriculum and implementation to other situations is difficult because it does not follow objective process for curriculum evaluation. These components have to be considered in evaluation of curriculum that

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is selection of observation team, observation schedule, way of observation and observation data collection techniques. Evaluation of curriculum evaluates the curriculum objectives, content of textbooks, teaching techniques, evaluation types and the process of curriculum in aspect of implemented according to desired plan or not (John & Lam, 2012).

Single National Science Curriculum (SNC)

It enriches knowledge about the natural environment by using steps of scientific method and develops the problem solving abilities in students. It is revised on the basis of standards of science, STSE content criteria, TIMSS content criteria, meeting 21st century skills and establishment of STSE and TIMSS in schools at different levels of schools. Single national curriculum presenters assume that it will not provide knowledge about scientific concepts but also develop positive attitude in students. Active learning approaches will be used e.g. mutual learning, supportive learning, analytical based learning, and classroom questions. Teacher will play the following roles in the delivery of instruction:

Teacher oriented ----------Student oriented

Product Based----------Process Based

Delivery of Information----------
Arrangement of Information

Direct Communication ----------
Facilitator & Guider

Role of learner has also changed:

Passive Learner------Active Learner

Answers oriented----------Questions oriented

Competitive Environment----------Two-way learning

Process of evaluation tries to meet the following objectives:

1. Understanding of scientific concepts.

2. Use of different scientific concepts to solve the problems.

Formative assessment will measure the performance of students at the beginning of instruction, diagnostic assessment measure the learning problems during instruction and summative assessment will assess the learning at the end of instruction (Govt. of Pakistan, 2020).

Bloom's Taxonomy

Bloom's taxonomy is used in describing unit objectives, test development, obtaining answers at different levels of taxonomy and enhancing the cognitive range of students. Bloom's taxonomy is based on three levels: Cognitive Domain, Effective Domain, Psychomotor domain. These three levels are hierarchal in nature and lower level learning provides base for higher level learning. Cognitive domain is linked with enlargement of intelligence and based on six categorize. These categories are designed from easy to difficult earning level of difficulties and mastery of initial levels become the base for getting expertise in the higher levels of learning (Chweu, Mji, & Mnisi, 2019)

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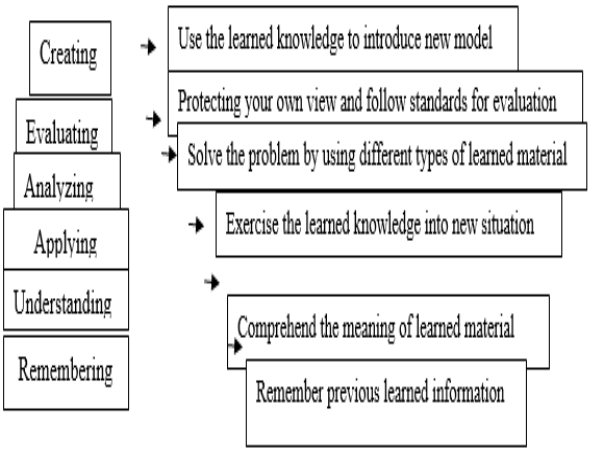

.(Revised Cognitive Domain of Bloom Taxonomy)

1. Knowledge

It is the lowest level of learning and students obtain knowledge about particular phenomena and recall the previously learned knowledge. Questions are asked from the students that are relevant about the learned concepts.

2. Understanding

At this level, students have clarity in the learned concepts and explain these concepts in their own style of interpretation.

3. Applying

At this level, students are in a position to apply the learned concepts in different fields of life for solving their problems.

4. Analyzing

Students will divide the learned concepts into different divisions and try to establish relationship between the concepts.

5. Evaluating

It's a difficult level of learning and students are in a position to analyze the advantages and disadvantages of the learned information.

6. Creating

It is the highest level of learning and students will produce new knowledge by using previous knowledge. Following action verbs are used in this domain:

Cognitive Domain	Action Verbs
Remembering	label, remind, name, highlight
Understanding	argue, explain, clarify
Applying	apply, infer, demonstrate
Analyzing	distinguish, investigate, resolve, condemn
Evaluating	arrange, generate, plan
Creating	assess, contrast, modify

Framework of 21st Century Skills in aspect of Cognitive Domain of Bloom's Taxonomy

Cognitive Domain	21st Century Skills
Remembering	-
Understanding	Communal and individual responsibility
Applying	Life and profession, nationality, Learning to learn
Analysis	Critical thinking, analytical and decision making abilities
Evaluation	Information Literacy
Creation	Originality and novelty

(Suto, 2013)

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Study conducted on "Application of Bloom's Taxonomy of Education Objectives in Writing Instructional Objectives for Sciences Subject at Secondary School Level: A Case Study of Sindh" recommended that Bloom's Taxonomy plays a significant role in the whole process of education and has to be used in writing learning objectives, curriculum development, and formulation of test items of exams. Research on "Curriculum Audit: An Analysis of Curriculum Alignment at Secondary Level in Punjab" suggested that further researches have to be conducted on resemblance of different types of curriculum of different subjects in Punjab.

Conclusion

The present research would show the role of Single National Science curriculum on the cognitive domain of Bloom's Taxonomy and also highlight the strengths of the curriculum that meets the requirements of 21st Century Skills. School plays a very important role in the future life of students and provides the basic knowledge and skills for surviving in the future life. Students choose those areas in the future in which they have the expertise in school life. Education plays a very important role in the development of individuals as well as in the country. Level of economic and societal development is based on the quality of education and it is the era of knowledge in which knowledge of science contributes a lot in the progress of a country (Basar & Yagci, 2017). Students' higher order thinking skills are actuated when they have to provide the answers of unknown questions. These skills become the base to bring variations in the performance of students when applied in science classrooms and enable them to apply the scientific data into the new circumstances (Gillies et al., 2014). Quality of school education is facing many problems that are training of teachers, development of textbooks and curriculum according to the international demands (Tahirkhell, Khan, Ayub, 2011). Students cannot manage the challenges of today job market without developing higher order thinking skills. Curriculum helps the teachers in developing these skills in the students because it provides guidance about goals, content, teaching methods and assessment techniques. Bloom's taxonomy plays a significant role in curriculum development (Karadag & Kaya, 2016). This taxonomy facilitates in the teaching learning process in aspect of designing learning activities and formulation of exam questions for evaluation of students' learning (Crowe, Dirks, Wenderoth, 2008).

I feel as researcher that National primary curriculum 2006 of public schools is less focused on learner-centered approach and development of higher order thinking skills in students such as creativity, critical thinking and problem solving. That's why; present Government has formulated the Single National Science Curriculum of Primary Classes to meet the mentioned challenges and will be implemented in the new academic session, March 2021. The new curriculum focuses on flipped classrooms, detailed description of learning activities for teachers, innovative and problem-solving skills, and Large Scale National Assessment by National Education Assessment System. It is clearly mentioned in the SNS 2021 that three levels of cognitive domain may be covered i.e. knowledge (40%), application (40%), and analysis (20%) (Govt. of Pakistan, 2020). It seems that the study has covered all the areas of topic and curriculum implementation phase should be properly planned to achieve the targeted objectives.

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