ANALYSIS OF CBSE QUESTION PAPERS IN BIOLOGY

Sunita Farkya
Professor
DESM, NCERT, New Delhi
sfarkya@gmail.com

B.K. Tripathi
Professor
DESM, NCERT, New Delhi

Quantitative and qualitative analysis of CBSE question papers in the subject Biology was done for the years 2012, 2013 and 2014. Questions asked in the question papers under the study were analysed on several parameters, including mental processes, form of question, difficulty level, content, marking scheme, time allotted for reflection, etc. A changing trend has been observed in the questions in the question papers from the years 2012 to 2014 that the assessment of rote memorisation has been replaced by the assessment of higher order thinking skills. It was observed that in the year 2013, value-based questions were introduced with a weightage of 7 per cent, which got reduced to 4 per cent of the total marks in the year 2014.

Introduction

Examination system in India, especially in school education, has largely been a paper-pencil test. Set of questions of theoretical nature are textbook-centric therefore, promote testing of rote memorisation and, to some extent, theoretical understanding of a learner. Consequently, overpowering the examination system does not encourage the inventiveness and creativity. In science, questions are usually framed for testing cognitive learning and outcomes of a learner based on Bloom's taxonomy of cognitive domains (Bloom et al., 1956; Anderson and Krathwohl, 2001). However, such a mode of assessment has been questioned on the ground that child's overall assessment is not being undertaken (NCERT, 2003, 2001, 2000, 1971). The National Curriculum Framework (NCF) 2005 and NFG position paper on examination reform (2005) have brought paradigm shift in our understanding and its implications towards the assessment of student's overall performance.

A question paper includes a set of items created on the basis of syllabus following a blueprint. The regulatory authority responsible to conduct examination develops the blueprint with the help of experts. Answers to these questions after judgment can demonstrate the achievement of certain level of learning in the learners. As learners are encouraged to achieve more in the examinations; the cognitive challenge of items in the question paper may influence students' study strategy for examinations considerably (Alison, Clarissa and Wenderoth, 2008). In the present scenario, learners appear in the examinations to get quantitative learning outcome and achieve certain levels of qualification standards. Answers presented by learners reveal the knowledge, understanding, competencies and skills acquired by them.

Major shortcoming observed in the type of questions in a question paper is that they mainly test the recall of memorised information and overlook the assessment of higher order thinking skills like understanding comprehension with associated competencies

such as reasoning, analysis and critical thinking (NCERT, 1999). Thus, the analysis of a question paper is very important to arrive at meaningful conclusion of the accuracy of the approach adopted to examine degree of achievements or learning outcomes in learners. Analysis records quantitative and qualitative data of each item that helps in further improvement keeping in view not only certain factors for overall development of learning but also to limit the stress about the examinations and keeping it reasonable throughout by creating the marking guidance.

Central Board of Secondary Education is one of the oldest and largest boards in school education in India, established in 1929. It has more than 16,000 affiliated schools in India and 24 other countries of the world. The board is committed to provide stress-free learning environment and evaluation procedure. Being the largest board of the council of the board of school education, it has huge beneficiaries as it reaches out to public domain at large that includes schools, teachers, students and parents, national and international bodies, etc. All CBSE-affiliated schools follow a uniform curriculum with a flexible scheme of studies suitable to the needs of each and every student. Despite the geographical variations, students of CBSE-affiliated schools take benefit in common sharing and privileges concerning curriculum, assessment and academic advances.

NCF–2005 recommends an evaluation procedure that can critically examine the learners' acquaintance with the subject matter without any psychological pressure, stress or fear for board examinations. It also promotes integration of various evaluation procedures with classroom life by encouraging transparency and internal assessment. Specific measures suggested by NCF–2005, include changing the typology of questions in the question paper, so that reasoning and creative ability replace rote memorisation, as the basis of evaluation. Assessment provides the degree of achievement of learning outcomes by a learner at a particular stage. Analysis of a question paper is important to know paradigm shift in the evaluation procedure for truthful judgment of the learner's achievement.

Broad curricular expectations as mentioned in NCF–2005 are as under:

1. To achieve scholastic and academic development of a learner.
2. To develop innovative problem-solvers.
3. To develop higher order skills like reasoning, analysis, lateral thinking, creativity and judgment as a substitute of rote memorisation among learners.
4. To inculcate values among learners.

The subject Biology has emerged as one of the separate disciplines of science at higher secondary level. Biology is study of life and life responds in many different ways. Although the nature of biology and nature of physical sciences share many common aspects, however, focus of biology creates unique philosophical, methodological and ethical premises on which biology should be understood and assessed (Kloser, 2012). The curriculum in Biology should provide learners with sufficient conceptual clarity of biological phenomena which will provide the basic understanding required to further learn about the intricacies of the concepts by developing higher order thinking skills (Handelsman et al., 2004; Knight, 2010). Curricular expectations in Biology Education outlined in the syllabus for secondary and higher secondary classes–2005 are as follows:

1. Identify basic principles behind various concepts and theories.

2. Build upon the perceptive of basic tools and techniques used in concepts to analyse various issues.
3. Stimulate critical and creative thinking in Biology.
4. Develop the creative skills of drawing sketches, etc.
5. Develop innovative problem-solving abilities to solve problems related to life situations.
6. Widen skills to illustrate linkages of elementary aspects of Biology with complex phenomena.
7. Connect biological concepts to real life problems.
8. Apply biological discoveries/ innovations in everyday life.
9. Integrate and interrelate the biological concepts with other areas of knowledge by underlying common principles.
10. Develop understanding of contribution of scientists that led to critical and important discoveries in Biology.

To ascertain whether the above objectives have been dealt within the classroom, a proper evaluation scheme is required. Thus, keeping in view the objectives of Biology Education with respect to assessment and evaluation, the analysis of Biology question papers of CBSE for years 2012, 2013 and 2014 is presented next. The analysis of individual questions may provide an insight about its validity for assessment of a learner, in view of the type of learners under different learning environments, more efficiently. It will also provide the quantitative data and scope for further improvement of the question paper.

Analysis Methodology

Qualitative and quantitative analysis of three sets of question papers of CBSE for years 2012, 2013 and 2014 was done on the basis of below mentioned indicators:

(i) If there is any repetition of identical questions year after year.

(ii) If there is any ambiguity/inadequate phrasing in question-stem.

(iii) Is the question really doing appropriate assessment of learner's competency in understanding of core concepts rather than knowledge of textbooks?

(iv) If the question paper shows uniformity with respect to syllabus, does it mean that questions were covered from the whole syllabus uniformly?

(v) Do the questions in the question paper categorise as : level of difficulty, topic area, form of questions; and competency being evaluated.

(vi) Judgemental marking convenience to provide full disclosure of transparency in grading and marks/grade reporting.

(vii) Does framing of any question involve more than one concept that assess the understanding of related core concepts?

(viii) Length of question paper *versus* time, giving enough opportunity for thoughtful reflections by learners.

Following criteria were fixed for meeting the quantitative analysis of the question papers in the study. The question papers for the years 2012, 2013 and 2014 were analysed to find out the following:

(i) Weightage given to questions assessing each of the mental processes — learners' competency to recall, provide reasoning, think critically, interpret, problem solving, and creative skills — in the question paper were established by calculating marks allotted against number of items in each category of the mental processes.

(ii) Weightage given to the questions covered from the content under the syllabus was calculated by the data gathered from the number of questions asked from each unit under syllabus with respect to marks allotted to it.

(iii) Weightage given to questions under different difficulty levels, including easy, average and difficult type of questions, was calculated by categorising the number of questions asked from each type of the difficulty level with respect to marks allotted to them.

(iv) Weightage given to the forms of questions including the number of very short answer type (VSA), short answer type I (S-I), short answer type II (S-II) and long answer (LA) type of questions in the question paper and marks allotted in each category.

Results and Discussion

A detailed qualitative and quantitative analysis of question papers based on the above mentioned indicators and criteria for years 2012, 2013 and 2014 is depicted in the document as *Annexures I, II and III* respectively.

1. **Weightage to mental processes:** Analysis of the question papers on the basis of percentage of marks allotted against number of questions included from each category of the mental process following Bloom's taxonomy in cognitive domain, *i.e.*, recall, reasoning, critical thinking, interpretation, problem-solving and Dave's in psychomotor domain, *i.e.*, creative skills. Results presented in Fig. 1 clearly indicate that the allocation of marks was highest in reasoning type of questions followed by questions to assess recall, interpretation and creative skills in the question paper in the year 2012. Very less weightage of only 6 per cent was given to assess critical thinking of a learner. In 2013, the highest weightage of 32 per cent was given to reasoning type of questions, followed by 31 per cent to recall type, 8.6 per cent to interpretation and 11.5 per cent to creative skills. Little weightage of 7 per cent was given to assess problem-solving ability in learners in the year 2013. To assess critical thinking ability, only 3 per cent of marks were allocated in the year 2013. The trend changed in 2014, when recall type of questions were replaced by reasoning and critical thinking in which marks allocated were 38.5 and 31.5 per cent respectively, followed by problem-solving, creative skills and interpretation. Value-based questions were given due weightage of 7 per cent in the years 2012 and 2013, which was reduced to 4 per cent in 2014. Besides, in 2013, value-based questions were asked under the category LA type of questions which were more open-ended and assessed learner's competency to comprehend in daily life situations. However, in the year 2014, the value-based questions were framed under the category S-II type of questions.
2. **Weightage to content:** Fig. 2 shows the analysis on the basis of weightage given as the percentage of marks allotted to the questions included from each unit of the textbook (for content areas) in the question paper. It is obvious from the data presented in Fig. 2, that the content coverage was more or less uniform.

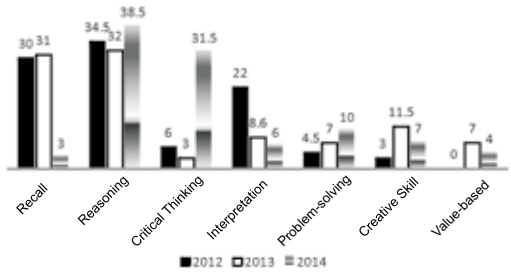

Fig 1. Analysis on the basic of % marks alloted against various mental processes

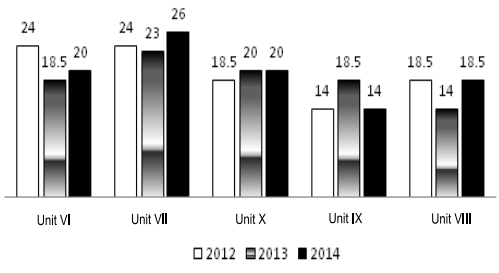

Fig 2. Analysis on the basis of % marks alloted against each Unit

3. **Weightage to the form of question**
   Weightage given to the form of question was as per blueprint prescribed by the board in all question papers under the study. Four categories of questions *viz.*, very short answer type question (VSA), short answer type question category I (S-I), short answer type question category II (S-II), long answer type question (LA) were included by 11.4 per cent, 28.57 per cent, and 38.57 per cent in the question papers of the years 2012, 2013 and 2014 respectively. Out of the total questions under LA category, 7.14 per cent of marks was allotted to value-based questions in 2012 and 2013, while the weightage was reduced in 2014 and only 4.28 per cent under S-II category was allocated to value-based questions.

4. **Weightage to the difficulty level of questions:** The data presented in the table below, reveal that the questions with high difficulty level are given more weightage followed by average and easy levels in the question papers of all the three years. The percentage of marks allotted to difficult questions were 38.57 per cent, 44.28 per cent and 45.71 per cent respectively and easy questions were 31.42 per cent, 25.71 per cent and 7.14 per cent respectively in the years 2012, 2013 and 2014. Here, a trend may be seen from the year 2012 to 2014 that the weightage given to high difficulty level questions is increasing and low difficulty level questions is decreasing.

5. **Comments regarding estimated time (site example)**
   Estimated time to answer all questions in question paper for year 2013 seems appropriate with little exception. It also gives learners time to rethink all questions for appropriate reflection of knowledge.

Difficulty Level of Questions

S. No.	Difficulty level	% marks allotted as per analysis		
		2012	2013	2014
1.	A	38.57	44.28	57.14
2.	B	30	30	35.71
3.	C	31.42	25.71	7.14

A–Difficult; B–Average; C–Easy

6. Other observations

(i) **Repetition of questions:** No question has been observed to be repeated from years 2012, 2013 to 2014.

(ii) **Inadequate information in question stem:** In the year 2013, question number 5 in SET 1, the information was insufficient in the question-stem. The question was framed as "What is the importance of MOET?", instead full form of MOET may be written in the question-stem. The question may be written as "What is the importance of multiple ovulation and embryo transfer (MOET)?

(iii) Almost uniform weightage has been given to the whole syllabus. Questions were asked uniformally from the entire content area.

(iv) **Paradigm shift in the assessment procedure:**

- Question paper of the year 2012 includes mostly recall type of questions which are replaced by questions based on different mental abilities like reasoning, critical thinking, etc., in 2013 and 2014.

  Attempt has been made to include some questions, about 19 per cent, from application in daily life in the years 2013 and 2014, however, it was about 13 per cent in 2012. It indicates that attempt has been made to assess conceptual understanding of the core concepts rather than the knowledge components.
- Value-based questions based on mental ability of recalling, reasoning and interpreting the facts, were introduced in 2013 and 2014.
- A recall type of question was asked from textbook of Class XI under very short answer type of question of 1 mark (Q#7), in 2014.
- In the year 2014, comparatively more choices were given in the individual questions to answer them.

7. Merits

- Most of the recall type questions are related to application in daily life, such as Q#13, 15, etc., in the year 2013, and Q#2, 23, 24, etc., in the year 2014.
- Questions are designed as per marking convenience. Marks are allotted so appropriately for good grade reporting. For example, Q#3, 15, 19, 28, etc., in the year 2013.
- Some questions assess understanding of more than one concept such as Q#6, 9, 12, etc., in the year 2013.
- Questions which assess learner's skills to illustrate linkage of simple aspects of Biology with complex phenomena have also been included, such as Q#1 and 6.
- Questions which assess creative skills of a learner based on metal ability of recalling in the question paper under analysis, have also been included.
- Several open-ended questions were a part of the paper in the year 2012, such as Q# 7 and 17; and few in the year 2013, such as Q# 26, which assess the learner's ability to comprehend. Due weightage has been given to such questions in the question paper of 2014.
- Questions to assess understanding about the contribution of scientists that led to critical and important discoveries in Biology have also been included in the year 2014, such as Q#12.

8. Limitations

- Some questions assessing memory are being included in question paper of 2013, such as Q#29, where the marking scheme too is not very clear in both the choices. In this case, grade reporting may not be fair.

- Several open-ended questions are a part of the paper in the year 2012, such as Q# 7 and 17; and few in the year 2013, such as Q# 26, which may lead to unfair marking as it is subjective.
- Less weightage for open-ended questions in 2013, hence no assessment of learner about the ability to comprehend.
- No space /weightage for MCQs in question papers of 2012, 2013 and 2014.

Conclusion

Currently, there is a continuing need for assessment practices in Biology that encourage learning of disciplinary knowledge and develop critical thinking skills in learners (Bird, 2014). A quick growth in the knowledge in the subject has raised challenges to develop assessment practices that provide students with the skills and knowledge to find, analyse, synthesise and apply information to new situations and problem-solving goals particularly in the subject (Brewer & Smith, 2011).

The contemporary practices adopted for evaluation are attempting to fulfil the objectives of Examination Reforms 2005. However, efforts are being made continuously by the board to improve and meet the requirements to fulfil those objectives. A shift in the method of assessment and evaluation is visible in the analysis of the question papers. This shift has impacted the blueprint and the question paper and finally the type of questions included in the question paper. The study reveals a shift in assessment questions increasing from recall type of questions to questions from higher order thinking skills, from the year 2012 to 2014. However, research-based efforts are needed to make fair, transparent, fearless and learner-friendly assessment and evaluation practices in Biology.

Annexure I

CBSE QUESTION PAPER ANALYSIS FOR Class XII – 2012

SET 1 **Max Marks: 70** **Duration: 3 hrs**

S. No. of the question	Unit of syllabus	Mental process — recall/higher mental abilities such as problem-solving, critical thinking, interpretation, reasoning.	Text-book based or not	Type of question LA S-I/S-II VSA/ OT	Marks allotted	Estimated difficulty level A-Difficult B-Average C-Easy	Estimated time reqd (minutes)	Remarks specificity and simplicity of language, task specification, scope of the question, language errors, within syllabus, quality of diagram and sketch, absence of inadequate instructions, etc.
1.	VI	Reasoning	YES	VSA	01	C	2	
2.	VIII	Reasoning	YES	VSA	01	B	2	

3.	VII	Reasoning	YES	VSA	01	C	2	
4.	X	Reasoning	YES	VSA	01	B	2	
5.	VI	Recall	YES	VSA	01	C	2	
6.	IX	Recall	YES	VSA	01	A	2	
7.	VII	Interpretation	YES	VSA	01	A	2	Open-ended, less marking, less timing
8.	X	Reasoning	YES	VSA	01	C	2	
9.	VI	Creative Skill	YES	S-I	02	A	4	
10.	VI	Recall	YES	S-I	02	B	4	
11.	VIII	Reasoning	YES	S-I	02	A	4	
12.	IX	Reasoning	YES	S-I	02	A	4	
13.	X	Recall	YES	S-I	02	C	4	Application in daily life
14.	VI	Reasoning	YES	S-I	02	B	4	
15.	VIII	Recall	YES	S-I	02	B	4	Open ended; choice is being given
16.	VII & IX	Recall	YES	S-I	02	A	4	
17.	VI & X	Reasoning	YES	S-I	02	B	4	Open-ended, less marking, less timing
18.	VIII	Recall	YES	S-I	02	A	4	
19.	VII	Reasoning	YES	S-II	03	A	6	Choice given
20.	VI	Interpretation	YES	S-II	03	B	6	
21.	VIII	Interpretation	YES	S-II	03	C	6	
22.	VII	Recall	YES	S-II	03	B	6	
23.	IX	Reasoning	YES	S-II	03	C	6	Application in daily life
24.	VIII	Recall	YES	S-II	03	A	6	Application in daily life

25.	VII	Recall	YES	S-II	03	C	6	Application in daily life
26.	X	Interpretation	YES	S-II	03	C	6	Choice is being given
27.	IX	Problem-solving	YES	S-II	03	A	6	
28.	X	Interpretation	YES	LA	05	B	20	Choice is being given, part of question is open ended
29.	VI	Reasoning	YES	LA	05	A	20	
30.	VII	Critical thinking	YES	LA	05	A	20	Choice is being given

Annexure II

CBSE QUESTION PAPER ANALYSIS FOR Class XII – 2013

SET 1 **Max Marks: 70** **Duration : 3 hrs**

S. No. of the ques-tion	Unit of syllabus	Mental process — recall/ higher mental abilities such as problem-solving, critical thinking, interpretation, reasoning, etc.	Text-book based or not	Type of question LA S-I/S-II VSA/ OT	Marks allotted	Estimated difficulty level A-Difficult B-Average C-Easy	Estimated time reqd (minutes)	Remarks specificity and simplicity of language, task specification, scope of the question, language errors, within syllabus, quality of diagram and sketch, absence of inadequate instructions, etc.
1.	VI	Critical thinking	YES	VSA	01	A	2	
2.	VIII	Interpretation	YES	VSA	01	B	2	
3.	VII	Recall	YES	VSA	01	C	2	

4.	VII	Reasoning	YES	VSA	01	B	2	
5.	VIII	Reasoning	YES	VSA	01	C	2	Inadequate language instruction
6.	IX	Critical thinking	YES	VSA	01	A	2	
7.	X	Recall	YES	VSA	01	C	2	
8.	X	Recall	YES	VSA	01	C	2	
9.	VI	Reasoning	YES	S-I	02	A	4	
10.	VI	Recall	YES	S-I	02	B	4	
11.	VIII	Problem-solving	YES	S-I	02	A	4	
12.	VIII	Interpretation	YES	S-I	02	A	4	
13.	IX	Recall	YES	S-I	02	C	4	Application in daily life
14.	IX	Recall	YES	S-I	02	B	4	
15.	IX	Recall	YES	S-I	02	B	4	Application in daily life; choice is being given
16.	X	Recall	YES	S-I	02	C	4	
17.	X	Reasoning	YES	S-I	02	B	4	
18.	X	Reasoning	YES	S-I	02	C	4	
19.	VI	Creative skill	YES	S-I	03	A	6	
20.	VII	Interpretation	YES	S-I	03	B	6	
21.	VII	Problem-solving	YES	S-I	03	C	6	
22.	VII	Recall	YES	S-I	03	B	6	
23.	IX	Reasoning	YES	S-I	03	C	6	Application in daily life
24.	VIII	Recall	YES	S-I	03	A	6	Application in daily life

25.	IX	Reasoning	YES	S-I	03	C	6	Application in daily life
26.	X	Reasoning	YES	S-I	03	C	6	
27.	X	Reasoning	YES	S-I	03	A	6	
28.	VI	Creative skill	YES	LA	05	B	20	Choice is being given in half part of question
29.	VIII	Recall, reasoning	YES	LA	05	A	20	Choice is being given
30.	VII	Value-based	YES	LA	05	A	20	

LA = Long answer question having 5 marks, S-I = Short answer question having 2 marks, S-II = Short answer type question having 3 or 4 marks, VSA= Very short answer type question having ½ or 1 mark, OT= Objective type question.

Annexure III

CBSE QUESTION PAPER ANALYSIS FOR Class XII – 2014

SET 1 **Max Marks: 70** **Duration: 3 hrs**

S. No. of the question	Unit of syllabus	Mental process — recall/ higher mental abilities such as problem-solving, critical thinking, interpretation, reasoning, etc.	Text-book based or not	Type of question LA S-I/S-II VSA/ OT	Marks allotted	Estimated difficulty level A-Difficult B-Average C-Easy	Estimated time reqd (minutes)	Remarks specificity and simplicity of language, task specification, scope of the question, language errors, within syllabus, quality of diagram and sketch, absence of inadequate instructions, etc.
1.	VI	Recall	YES	VSA	01	B	2	
2.	VII	Reasoning, interpretation	YES	VSA	01	A	2	Interpretation
3.	VIII	Reasoning	YES	VSA	01	B	2	
4.	IX	Reasoning	YES	VSA	01	A	2	
5.	X	Reasoning	YES	VSA	01	C	2	

6.	X	Reasoning	YES	VSA	01	A	2	
7.	I	Recall	YES	VSA	01	C	2	From textbook of Class 11
8.	X	Reasoning	YES	VSA	01	B	2	
9.	VI	Critical thinking	YES	S-I	02	A	4	
10.	VII	Problem-solving, critical thinking	YES	S-I	02	B	4	
11.	VII	Problem-solving, critical thinking	YES	S-I	02	A	4	Choice has been given
12.	VII	Recall, Reasoning	YES	S-I	02	A	4	
13.	VIII	Reasoning	YES	S-I	02	B	4	Application in daily life
14.	IX	Reasoning	YES	S-I	02	A	4	
15.	IX	Reasoning	YES	S-I	02	A	4	Application in daily life
16.	X	Critical thinking, creative skill	YES	S-I	02	B	4	
17.	X	Reasoning	YES	S-I	02	B	4	
18.	IX	Critical thinking	YES	S-I	02	A	4	
19.	VI	Reasoning	YES	S-II	03	A	6	
20.	VI	Reasoning	YES	S-II	03	B	6	
21.	VII	Creative thinking	YES	S-II	03	A	6	Choice has been given
22.	VII	Value-based	YES	S-II	03	B	6	Difficult language

23.	VIII	Recall, reasoning	YES	S-II	03	C	6	Application in daily life
24.	VIII	Critical thinking	YES	S-II	03	A	6	Application in daily life
25.	IX	Problem-solving, critical thinking	YES	S-II	03	A	6	Application in daily life
26.	X	Interpretation, reasoning	YES	S-II	03	B	6	Choice is being given
27.	X	Recall, reasoning	YES	S-II	03	A	6	
28.	VI	Recall, creative skill	YES	LA	05	B	20	Choice is being given in half part of question
29.	VII	Reasoning, critical thinking	YES	LA	05	A	20	Choice is being given
30.	VIII	Reasoning, creative thinking	YES	LA	05	A	20	Choice is being given

LA = Long answer question having 5 marks, S-I=Short answer question having 2 marks, S-II = Short answer type question having 3 or 4 marks, VSA= Very short answer type question having ½ or 1 mark, OT= Objective type question.

References

Alison C., D. Clarissa and M.P. Wenderoth. 2008. Biology in Bloom: Implementing Bloom's Taxonomy to Enhance Student Learning in Biology. *CBE - Life Science Education*. 7: 368–381.

Anderson, L.W. and D.R. Krathwohl. 2001. A Taxonomy for Learning, Teaching and Assessing: A Raision of Bloom's Taxonomy of Educational Objectives — Complete Edition. New York, NY: Longman.

Bird, F.L. 2014. Assessment in Biology: Trends, Problems and Solutions. *International Journal of Innovation in Science and Mathematics Education*. 22(2), 85–99.

Bloom, B.S., M. Engelhart, E.J. Furst, W. Hill and D.R. Krathwohl. 1956. *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain*. New York, NY: Longman.

BREWER, C. AND D. SMITH (EDS). 2011. *Vision and Change in Undergraduate Biology Education.* Washington, DC: American Association for the Advancement of Science.

HANDELSMAN, J., D. EGERT-MAY, R. BEICHER, P. BRUNS, A. CHANGE, R. DEHAAN ET AL. 2004. Scientific Teaching. *Science*. 304, 521–522.

KLOSER, M. 2012. A Place for the Nature of Biology in Biology Education. *Electronic Journal of Science Education*. 16(1), 1–18.

KNIGHT, J. K. 2010. Biology Concept Assessment Tools: Design and Tools. Microbiology Australia, 5–8.

NCERT. 1971. Report of the Committee on Examinations, CABE, Ministry of Education on Social Welfare, New Delhi, India.

___. 1999. *Critical Analysis of Question Papers of Four Boards of School Education (Class XIII),* DEME.

___. 2000. *National Curriculum Framework for School Education*. New Delhi, India.

___. 2001. *Grading in Schools*. National Council of Educational Research and Training, New Delhi, India.

___. 2003. *Continuous and Comprehensive Evaluation — Teacher's Handbook for Primary Stage*. National Council of Educational Research and Training, New Delhi, India.

___. 2005. *National Curriculum Framework*. New Delhi, India.

___. 2005. *Position Paper of National Focus Group on Examination Reforms*. New Delhi, India.

___. 2005. *Position Paper of National Focus Group on Teaching of Science*. New Delhi, India.

___. 2005. *Syllabus for Secondary and Higher Secondary Classes, National Curriculum Framework*. New Delhi, India.