Chapter 15

OPEN BOOK ENVIRONMENT (OBEnv): A Tool for Developing Critical and Creative Thinking

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INTRODUCTION

A good education system leads a society in the positive direction making children fit for the society and prepares them for the betterment of the society. In the context of the present time, curriculum design is based on the changing pattern of society. Due to the changing global order in the context of liberalization, privatization and globalization, there is a drastic change in the education curriculum and it is a continuous process of change. National Curriculum Framework (2005) of NCERT tried to highlight a few concerns that may be related to the present system. "There is a deep disquiet about several aspects of our educational practice: (a) the school system is characterized by a inflexibility that makes it resistant to change; (b) learning has become an isolated activity, which does not encourage children to link knowledge with their lives in any organic or vital way; (c)schools promote a regime of thought that discourages creative thinking and insights; (d) what is presented and transmitted in the name of learning in schools bypasses vital dimensions of human capacity to create new knowledge; (e) the 'future' of the child has taken center stage to the near exclusion of the child's 'present', which is detrimental to the wellbeing of child as well as the society and the nation.' In the other words it can be said that instead of having a child centered education we are moving towards an examination centered education system where the child uses its mind to a minimum extent by giving more emphasis on rote memorization. Examination is considered vital in the process of education and all other aspects of education are manipulated to have a good examination score. The consequence is very much seen in the system having a teacher centered method of teaching and rote memory centered method of evaluation. Further, the scenario is becoming more challenging due

to the Industrial Revolution 4.0 which is evolving at an exponential rather than a linear pace and changing the way people live, work and study. It is affecting almost every industry in every country in terms of production, management, and governance. It needs the learning approach of Education 4.0 to go hand in hand with the Industrial Revolution 4.0. It needs specialized skills for the youth as The World Economic Forum (2018) urged for the skills like, complex problem-solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgement, and decision making, service orientation, negotiation and cognitive flexibility. Hence the new Education 4.0 paradigm demands new approaches for learning and evaluation at all the levels of education. The new National Education Policy (2020) also tried to deemphasize the rote learning nature of present practice of teaching learning and examination stating that 'emphasis on conceptual understanding rather than rote learning and learning for exams'. There is a felt need to improve both the instructional process and evaluation of the education process. In this changing scenario and need, there is a necessity to have some sort of tool to influence the process of teaching, learning and evaluation in Indian schools. Open Book Environment (OBEnv) is one such tool which can help in bringing the said desired outputs in the system of education. Though an open book environment is a tool necessity for the open book examination, it also can be used as a process intervention tool independently to eliminate memorization among students and for the development of mental faculties using critical thinking, creative thinking and problem-solving.

OBEnv as a pedagogical tool was conceived and developed by Biswal and Das in 2004. Since then, the system has been in use for teaching, experimentation, and projects in elementary, secondary and higher education levels. It was a part of a major Indian Council for Social Science Research (ICSSR) project of Biswal (2014), a major University Grants Commission (UGC) project of Das (2014), a major ICSSR project of Das (2018), an Institute of Advanced Studies in Education (IASE) project of Das and Biswal (2015), Ph.D. work by Maity (2016) and Jana (2019). OBEnv has also been experimented in the Faculty of Management Studies, The Maharaja Sayajirao University of Baroda during (2004-2018) as an intervention at higher education. Year-Long implementations of OBEnv in Schools like University Experimental School, Vadodara, and Satya Sai Vidyavihar, Navsari proved its effectiveness in the school education.

THEORETICAL BACKGROUND

The theoretical background of the present tool is derived from the learning theories and principles like Discovery Learning of Jerome Bruner (1961), Multistore Model of Atkinson & Shiffrin (1968), Working Memory Model of Baddeley and Hitch (1974) and Bloom's Revised Taxonomy (2000).

Discovery Learning of Jerome Bruner (1961) is an approach to instruction through which students interact with their environment by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments, while drawing on their own experience and prior knowledge. Environment has bigger role in learning development. Bruner argued that social factors particularly language were important for cognitive growth of learners. It is an Inquiry based learning. Discovery learning can occur whenever the student is not provided with an exact answer but rather the materials in order to find the answer themselves. The steps like collaborative learning and inter group discussion of the OBEnv are added from the assumptions of discovery learning model of Bruner like, pose a question and let students try to find the answer and encourage students to make intuitive guesses.

Some of the procedure of OBEnv is taken from the Multi-Store Model of Memory of Atkinson and Shiffrin (1968) that talks about the memory which is made up of separate structures like sensory stores, the short-term store, and the long-term store with the help of control processes like, attention, rehearsal, coding, search and retrieval. Even after more than 50 years, this memory model is still relevant today and found useful in OBEnv. Attempt is made in the present tool to send the sensory information to long term store through sensory store and short-term store with the help of social and group attention, activities and meaningful rehearsals to make the memory permanent and long lasting. The control processes of searching for and retrieval of information in the short-term and long-term stores is strengthened in the OBEnv with the help of active sensory stimuli and concept mapping. One can retrieve information from our long-term memory by using active search processes using spatial relations with very less memorization.

In OBEnv, the components of content flowchart and concept mapping were added with the help of Working Memory Model (WMM) of Baddeley and Hitch (1974). This model consisted of three main sections with a fourth section added in 2000 by Baddeley like Supervisory System called Central Executive and Slave Systems called The Phonological Loop (e.g., language), The Visuo-Spatial Sketchpad (visual semantics) and Episodic Buffer (added in 2000) (short term episodic memory). In WMM short term memory of the Multi store model has been replaced with Visual Spatial working memory, information we hold and manipulate in our conscious attention. The central executive has the ability to store information, but its capacity is limited. The articulatory control system of the Phonological Loop revives memory traces with all auditory information believed to directly enter the phonological store. The Visuo-Spatial Sketchpad is believed to hold visual information. The added Episodic Buffer is to link together every piece of information from all other elements of working memory with

further information relating to time and order. This process enables memories to be prepared for episodic long term memory storage. This working memory model seems perfectly realistic because it ties in with the manipulation of information when problems are encountered and solved. This model shows short term memory to be a dynamic process.

OBEnv brought its essence of higher order thinking from Bloom's Revised Taxonomy (2000). It provides learning objectives in hierarchical order. It divides thinking skills in two categories: lower order and higher order thinking skills. For higher order thinking processes, lower order thinking creates a foundation. In OBEnv much emphasis is given for the development of higher order thinking skills like Applying, Analyzing, Evaluating & Creating on the basis of a strong foundation of knowing and understanding.

LITERATURE REVIEW

Few research literatures were found that either supported the OBEnv or argued and suggested the need of a tool like OBEnv. The study of Gharib and Phillips (2013) on tests of anxiety, student preferences and performance on different types of examination found students slightly better on open book examinations and had lower levels of anxiety than on cheat sheet examinations. Karagiannopoulou and Milienos (2013) found students who preferred the open-book examination scored lower on 'time management', 'achievement', and 'unrelated memorizing' which suggested an environment for OBE. Chatterjee (2014) develops a strategy like OBE including the steps like content presentation through power-point, collaborative learning activities with cognitive questions, cross group sharing and deliberations, putting knowledge into action and concept mapping etc. to teach economics to standard XI students for open book examination with a control group following the traditional approach of teaching. The major findings revealed that students taught economics through the developed strategy for open book examination scored significantly more than the control group. Jalal, Fadhil, and Hasini (2014) found that students only did well in the open book assessment; those were well prepared and had a deep understanding of the current and prerequisite subjects. Das (2015) studied the effectiveness of an open book examination system having two components viz. open book environment and open book testing for standard VIII students in terms of the content knowledge, logic, divergent thinking, comprehension, achievement of students and reaction of students and teachers. The findings of the study revealed that (a) open book examination system was found significantly effective in comparison to traditional examination system in enhancing scores in most of the subjects and most of the components; (b) and both teachers and students showed positive reaction towards both open book environment and open book testing separately and as a whole. Biswal and Das (2016) conducted a study to see the

effectiveness of the open book examination in terms of the achievement of standard VIII students in English, Gujarati, Hindi, Mathematics, Science and Social Sciences subjects along with the examination anxiety with a sample of randomly selected 670 students. Open book examination was found to be effective in enhancing the achievement of students in English, Gujarati, Hindi, Science Social, Science and Mathematics. It also helped to reduce examination anxiety. Maity (2016) conducted a study on the effectiveness of open book examination in English in different environments (OBEnv and traditional environment) in terms of content knowledge, logic, divergent thinking, comprehension, and overall achievement. The findings revealed similar achievement in all the components between Close Book Testing (CBT) and Open Book Testing (OBT) in a traditional environment, whereas the achievement in open book testing was found significantly better in comparison to the same in close book testing in an open book environment. Students taught through OBEnv showed their positively agreed response in most of the components related to OBEnv and OBT separately and as a whole. Biswal (2015) investigated an open book examination system for secondary school students in different teaching learning environments with the objectives to design an open book environment for standard VIII students for all subjects and to study the effectiveness of the open book environment. Major findings of the study revealed that (a) in a traditional environment the result of close book testing and open book testing were found similar in most of the subjects; (b) in an open book environment the result of close book testing and open book testing were found similar in most of the subjects; (c) in an open book testing, open book environment was found significantly better than traditional environment in all the subjects; (d) in a closed book testing, open book environment was found significantly better than traditional environment in enhancing scores of all the subjects; (e) both open book environment and open book testing were found effective in terms of the reaction of students; (f) open book environment helped students to write answers in a better way in both open book testing and close book testing with divergent ideas, content knowledge and sound logic along with the comprehension of the subjects. It also helped students to score better in their overall achievement. A study conducted by Das and Delawala (2019) to know the impact of the open book examination on standard VIII students in terms of the academic achievement and examination anxiety found no significant difference in the mean achievement score of English, Social Science, Mathematics, Hindi, Gujarati and in overall subjects appeared examination through traditional close book examination and open book examination, whereas, the achievement in science subject was found to be significantly greater in case of open book examination. Even no significant difference was noticed between the mean examination anxiety level of students who appeared in the close book examination and open book examination. The study suggested the need for an open book environment for the students to do better

in open book examinations and to develop their thinking abilities. Jana (2019) conducted a study with the objectives to design and develop an Open Book Environment (OBEnv) for standard VIII students in teaching Social science and to study the effectiveness of the developed open book environment in terms of the achievement of standard VIII students in Social science and the reaction of student towards developed open book environment. The major findings revealed that in an open book examination (OBE), an open book environment was found significantly better than a traditional close book environment in terms of enhancing scores in content knowledge in social science, logic, and divergent thinking. Open book examination including open book environment (OBEnv) and open book testing (OBT) was found effective in terms of the reaction of students.

From the studies reviewed, the studies of Das (2015), Biswal and Das (2016), Maity (2016), Biswal (2015), Jana (2019) proved the superiority of an open book environment in terms of better achievement, better thinking, and decreased examination anxiety. Studies conducted by Chatterjee (2014) and Das and Delawala (2019) also suggested the open book environment for the success in open book testing. One the basis of this review of studies, it can be said that OBEnv is a good tool for enhancing achievement, developing thinking, and reducing examination anxiety and hence suggested here for developing thinking abilities of present and future teachers.

EXPLANATION OF THE TOOL

OBEnv is a pedagogical tool to help students for better achievement, reducing examination anxiety along with developing thinking skills. An OBEnv helps students to acquire new knowledge, to modify existing knowledge on the basis of new experience, to build new knowledge to solve problems and make intelligent decisions. It is more processing of information, rather information content itself. It helps students to think and rethink the gained knowledge to make it more practical and application oriented. This is done by activating learning through questions, giving different examples, doing exercises, projects, assignments, and so on. In this process, the focus shifts from rote learning to the development of certain mental faculties.

Open book examination system consists of two components: (i) Open Book Examination (OBE) and (ii) Open Book Environment (OBEnv). Open book examination also called as open book testing is a commonly used pattern of examination where students are allowed to refer and copy from a list of approved material or books during the examination. It is related to the product aspect of the teaching learning system, whereas open book environment (OBEnv) is related to the process aspect of the teaching learning system. OBEnv prepares students for open book examination along with the development of thinking skills

particularly critical and creative thinking. Open book examination requires an open book environment without which there is no meaning in this system. OBEnv is the spine of open book examination. It helps to reduce anxiety and promote learning (Biswal & Das, 2016; Green, S. G., Ferrante, C. J.& Heppard, K. A. 2016; Das & Delawala, 2017). Open Book Environment improves academic achievement in open book examination (Das and Delawala, 2019; Das, 2014; Jana, 2019; Maity, 2016). One of the most important components of the open book environment is the transaction of the content in the class by the teachers in such a way that it would help the students to think and to develop higher order thinking skills without compromising on the achievement in different subjects. Hence, an attempt is made in this tool to have a balance between these two components.

AIMS OF THE TOOL

- To bring a change in the current practice of teacher centered teaching learning process and the rote memory centred examination.
- To bring lots of activities inside the class making it more live and dynamic. To make the classes happy and joyful.
- To develop a better understanding of the content among students.
- To develop skills like critical thinking, creative thinking and problem-solving among students.
- To develop social skills among students.

EXPECTED OUTCOME

From the results found from the experiments on the OBEnv, the following outcomes could be expected from the successful implementation of this tool following the prescribed steps.

- It could increase the achievement of students in all subjects.
- It would help to develop critical thinking, creative thinking and problem-solving among students.
- Attendance of the students would be increased when it is not compulsory.
- It would ensure maximum participation of students in classroom discussion and activities.
- It would motivate students to use a variety of reference materials.
- Students would be satisfied with their answers.
- Answers of students would be based on logic and there would be varieties of answers and examples from students.
- It would help students to develop social and life skills like discipline, cooperation, leadership, respecting each other, communication etc.

ALLOCATED TIME

The present tool can be used in the general school timetable. It can be used in the allotted time of 35 minutes to 60 minutes of class. While using this tool, teachers would be more vigilant in time management, as a little more time needs to be spent in intra group discussion and inter group sharing, whereas time could be saved for these activities through the use of available technology. These activities could be integrated in the timetable in such a way that different steps could be performed in different periods if the time slot is less than 35 minutes. It is experienced that the courses of different subjects would be completed within the allotted time.

SETTING

The present tool is quite generic in nature and can be used for any type of theoretical subjects. No special setting is needed to use this tool. It can be best managed in general classrooms with 30-40 students. In case of overcrowded classrooms, teachers need to take care and manage while arranging the intra-group discussion so that students can sit comfortably in groups for 10-15 minutes so that they can come out with the answer of the given cognitive questions.

ROLE OF TEACHERS AND STUDENTS

Before using this tool, it is very essential for the teachers to motivate students to participate maximally in the classroom activities. To some extent, it should be ensured to avoid the strict classroom discipline and silence to allow students to express themselves. A student friendly teacher is a better option in comparison to a strict teacher. It is observed from the previous experiences that students used to be self-disciplined while working in the OBEnv process. Here, the teachers need to develop the skills of attending students' responses and to listen to them maximally. Punishment in any form has no role while using this tool that desires specific behavior of teachers and students. Teachers need to be more of a mentor and co-worker with the students giving guidance from time to time.

STEPS TO USE THE TOOL

For this purpose, following nine step procedure is followed to make this tool effective and practical while teaching a subject content in the class.

1. **Content Flow Chart / Content to be Covered:** It includes the points of discussion in the classroom for a specific topic including the units and subunits of the content to be covered in a class through a line flow chart.
2. **Learning Objectives:** It refers to the expected outcome of a content of teaching in terms of change in students' behavior both in a short period of

time and a long span of time. Hence, a combination of both general as well as specific educational objectives will be kept to be achieved after completion of a specific topic in terms of knowledge, understanding, reflections and skills. For example, after Completion of the content students will,

- develop understanding about the animal and plant cell (subject - Science and topic - Cell),
- understand basic pattern of crop production in India (subject - SS and topic - Crops in India,
- imagine the social pattern, the poet wants to depict (subject - English and topic - The Geography Lesson - poem),
- develop critical and creative thinking,
- develop social skills.

3. **Content Presentation in Brief by the use of Technology:** It is one of the very important aspects of the OBEnv tool where attempt would be made to prepare certain teaching learning materials like, powerpoint presentation, collection of video clips and audio clips etc. as per the availability of the materials in the open and free source from internet. Major purpose behind the development of such material is to make students thoroughly understand the topic and to have good achievement in their examinations. Apart from this, the developed material will help teachers to present and explain the content briefly by saving some time for doing other activities related to thinking.
4. **Questions of Cognitive Conflict / Cognition / Cognitive Reflection:** At this stage, teachers need to prepare five to ten questions of very higher order thinking like analyzing, evaluating, and Creating on every content unit of teaching. These are the questions to make the whole class think in small groups after completion of each unit through brainstorming using the acquired content knowledge. Questions of Cognitive conflict type are the questions to create a conflicting situation in the mind of the students related to the learned content and to find the possible answers to these questions. These are the best type of questions at the creating levels to develop critical and creative thinking among students. In the contents where questions of cognitive conflicts are not possible, the questions of simple cognition or cognitive reflection would be prepared. These are mostly analyzing and evaluating level questions. These are a few examples of questions of Cognition/Cognitive Conflict/Cognitive Reflection from Indian school subjects.
    - What could happen to human beings if their cells could have chlorophyll? (Science, Cell).
    - What would happen if water were only in liquid form? (Language, Water Dance).

- What would be the scenario if there were no combustible substances on the earth? (Science, Combustion).
- Imagine the situation if East India Company would not establish their territory in India? (Social Science, East India Company).
- How would our life be, if there would be no friendly microorganisms? (Science, Micro Organs).

5. Collaborative Learning Activities/Intra-group Discussion

Small groups working with different cognitive questions are called collaborative learning activities. This activity is designed to make the students work collaboratively in small groups. The class can be divided into small groups consisting of four to five members and one question of cognitive conflict/cognitive reflection would be given to each group. The groups would be given 10 to 15 minutes of time to come out with the answers to the cognitive questions having brainstorming, discussion and making a consensus about the answers of the cognitive questions. The purpose of this activity is to have more thinking when working with a group using more brains, a habit of working in a group, to have a consensus in case of divergent answers, and to allow the group to think in a social norm. After the brainstorming and discussion among the groups they would prepare a write up or activity which would be presented by group member/s in the whole class.

6. Inter-group Sharing

It is the stage to develop critical and creative thinking among students through **c**onfirming and expanding their thinking. After completion of the discussion among themselves and having an answer/solution of the cognitive question, one or more members of each group would present their answers to the cognitive question and discussion points that they had done in the group in the inter group discussion or sharing. A maximum 4-5 minutes would be provided to each group for this purpose. The purpose of this activity is to let the whole class know the answer to different cognitive questions and to have learning sessions through their answers. In this activity, the role of the teacher is not to evaluate the answers of the groups, rather to support, encourage and appreciate the groups for thinking in different ways. As there is no right or wrong answer for any cognitive question and the degree of rightness of an answer depends on the use of proper content knowledge and the suitable logic, teachers are advised not to evaluate the answers to the cognitive questions, rather the teachers would steer the direction of thinking of the groups, if it is found that any group is going with wrong idea or thinking. During the presentation, members of other groups are allowed to add some new ideas in their line of thinking. At the end of this session, after all the groups presented their answers, the teachers will be

advised to conclude the session by taking the main concepts of the whole presentations in brief.

7. Question-Answer Session

It is the stage for the students to clarify the concepts, clear the doubts, solidify the existing understanding and to prepare themselves for mainstream examination as well. Apart from developing critical and creative thinking through OBEnv, students will also be prepared for their examinations and to have better academic achievements. So, it is planned to have a question answer session to discuss the exercises of the textbook. Hence, at the end of each and every chapter/unit of the content, teachers are asked to discuss each and every probable question of the content that could be asked in the examinations with the possible answers. During the content presentation teachers will also ask the probable questions from the chapters. Here maximum care would be taken not to change the traditional practice of the class considering the traditional examination-oriented practice of students along with the development of critical and creative thinking.

8. Concept Mapping

In the present tool, students are supposed to do well in their examination and to have good marks in their achievement tests along with the development of critical and creative thinking. Though maximum emphasis would be given on developing higher order thinking skills, the lower order thinking skills like knowledge and understanding would not be ignored. As more questions in the examination are of knowledge level and students need to memorize a lot of their content, concept mapping is added in the process that would help to sharpen their memory, replace memorization and to enhance their space relation and visual literacy which indirectly will help them in their mainstream examinations. Hence, at the end of each chapter, students would be asked to prepare a concept-map on their own on the basis of their understanding of different components they were taught and to keep those in mind. Through the concept map, teachers whatever taught in the class and students whatever understood about the taught content, need to prepare a pictorial or line diagram of important points related to the whole content in a compact way which could be kept in the mind in such a way that it could be visualized by the students at any point of time and they can get the information from it. As very less emphasis is given to memorization in the OBEnv, the concept mapping would be used to make the process of memorization easier.

9. Questions for Open Book Examination

OBEnv is designed to prepare each and every student to perform well in the Open Book Examination at the end of a session. This is the stage for

students to get questions for open book examination from different chapters easily and to make students aware about different types of questions. Hence, 5 to 10 questions for open book examination in each and every subject would be asked by the teachers and those would be discussed during the regular teaching learning process. Following are some questions for the open book examination.

- Why are all bacteria not pathogens? (Science, Micro Organs).
- Suggest some preventive measures to avoid pathogens. (Science, Micro Organs).
- How can we do irrigation in dry land? (Social Science, Irrigation).
- Which is the most suitable traditional method of irrigation? Why? (Social Science, Irrigation).
- What animal cells should learn from plant cells? (Science, Cell).
- If mean=median=mode, whether the group is normal? Justify your answer. (Mathematics, Measures of central tendencies).

These questions can also be asked to the students in the form of an open book examination to test their achievement and thinking style as a part of the evaluation of the tool.

ASSIGNMENTS

At the end of every chapter, individual application-oriented assignments would be given to students related to the surrounding environment including society, newspapers, TV, internet etc. This component is designed to have a higher order thinking among students which could have some relevance in the society and the surroundings. Like homework, teachers would be asked to check the assignments of each and every student and to provide feedback accordingly.

STUDENTS' FEEDBACK

Regarding OBEnv students said that it was a realistic teaching-learning environment, and it was a less stressed environment. It helped them to be more extroverted and logical in giving responses either oral or written. It helped them to think critically and creatively during the stages like intra group discussion and inter group sharing. Students find it fun while working in the groups. Cognitive questions compelled them to think out of the box. They learned social skills like respecting others' views, cooperating, and helping each other from the group work. Regarding the open book examination, they observed that they got a different test of examination. It helped them to apply the knowledge learned during the course, it helped them to take the examination easy and found it a part of the teaching learning process. They opined that though it was difficult

for them to answer the questions asked in the open book examination, they liked the questions.

CONCLUSION

The tool OBEnv is one of the alternatives of traditional teaching learning and evaluation having the potential to enhance achievement, to reduce memorization, to reduce examination anxiety and to develop critical and creative thinking among learners of all ages. It is a tool which can be used with or without an open book examination. It is a generic tool which can be used by any teacher at any level for any subject. It has the potential to transform and revamp the present practices in a more meaningful way which is the need of the hour. This tool has the potential to mitigate the impact of the industrial revolution 4.0 and to prepare the future workforce with 21st century skills like critical thinking, creative thinking, problem-solving and effective communication. More and more teachers need to be trained to use this tool in their regular classroom. Following the given nine steps, the tool can be used by the teachers to make their classes more interesting and skill oriented. The steps like preparing cognitive questions, intra group discussion with the help of brainstorming and discussion, inter group sharing and concept mapping are very important aspects of this tool and need lots of initiatives and practices. It also needs continuous practice and improvement. It can be done through regular training and peer help. It needs more research and a proactive approach to implement at different levels of school education for different subjects.

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