Science Literacy Investigations in O’ Level Science Curriculum: The Case of Uganda

Background

Scientific Literacy (SL): In Uganda, one of the national goals of education is to promote scientific and technological orientation of education at all levels and to promote development of the ability to use data and information for decision-making. Emphasized by the Government White Paper on Education (1992), a scientifically literate person is regarded as having a range of investigative skills and understanding of the nature of science and the interaction between science, technology and society in order to function in the modern society.

Four themes:

In 2005, Compulsory Science Policy was introduced in Uganda for O’ level with the aim of: a) increasing the critical mass of people with science knowledge; b) increasing the number of scientists; and c) improving performance in science and mathematics. With the aims of CSP, all learners at O’ level are expected to study science subjects, which consists of Biology, Chemistry, and Physics. To meet the challenges of improving SL, Science curricula need to be balanced, stressing equal proportions of the following themes:

1. Basic knowledge of science (Theme I);
2. Investigative nature of science (Theme II);
3. Science as a way of thinking (Theme III);
4. Interaction of science, technology and society (Theme IV).

Objectives:

This study investigates the balance between and emphasis on SL themes in Ugandan O’ level Science syllabuses, textbooks and Uganda Certificate of Education (UCE) examination papers. In particular, the study attempts to examine whether or not the current Science courses have the potential to contribute to the preparation of scientifically literate citizens in Uganda. The study explore the following questions:

1. What content is emphasized in the science syllabuses, textbooks and examinations relative to the four themes of SL mentioned above?
2. Does the O’ level Science syllabuses differ from the science textbooks and UCE examinations with regard to their treatment of the four themes of SL?
3. Do the Science courses have the potential to contribute to the preparation of scientifically literate citizens?
Key Findings

**Syllabuses:**
All of the four themes of SL are represented in both Biology and Chemistry syllabus in varying degrees with investigative nature of science (Theme II) receiving more representation. In the Physics syllabus, basic knowledge of science (Theme I) receives the most representation out of the four themes.

**Textbooks:**
Both Biology and Chemistry textbooks place most emphasis on basic knowledge of science with an overall mean of 72%, followed by the investigative nature of science (Biology 35%; Chemistry 19%). Less emphasis is placed on science as a way of thinking (Biology 17%; Chemistry 6 %) and even less on the interaction of science, technology and society (Biology 1%; Chemistry 3%). Physics textbooks place most emphasis on basic knowledge of science with an overall mean of 48%, followed by science as a way of knowing (19%). Less emphasis is placed on the investigative nature of science (17%) and even less on the interaction of science, technology and society (16%).

**Examinations:**
Variations exist in examinations among the three subjects.

1. **Biology:** Basic knowledge of science is the most emphasized theme (47%), followed by the investigative nature of science (35%) and science as a way of thinking (17%). Nearly neglected is the theme of interaction of science, technology and society (1%).
2. **Chemistry:** The most emphasized theme is the investigative nature of science (64%), followed by science as a way of thinking (20%) and the basic knowledge of science (16%). Nearly neglected is the theme of interaction of science, technology and society (1%).
3. **Physics:** The most emphasized theme is the basic knowledge of science (41%), followed by investigative nature of science (33%) and science as a way of knowing (24%). Nearly neglected is the theme of interaction of science, technology and society (3%).

The inconsistent representation of SL themes in all the Science curricula materials could be attributed to the nature, purposes and the authors of these materials. The Science syllabuses are written as the main guide of science instruction in secondary schools, hence the better representation of SL themes. Textbook authors may have written their books to mainly deliver scientific facts. Generally, the theory examination papers are intended to assess learners’ application of scientific knowledge and skills to new situations. The practical papers as laboratory-based examinations are aimed at assessing learners’ knowledge and skills for performing, conducting experiments and communicating the findings.
Discussion

1. Focus group discussions:

Focus group discussions were conducted with 24 teachers from 8 schools. Most of them shared similar views around their understanding of SL. According to them, science syllabuses, textbooks and UCE examinations, all tend to lay very little emphasis on SL. Particularly, the textbooks tend to provide a lot of information that can help students to pass examinations rather than promoting SL.

2. Lesson observations:

There is no evidence that the implementation of the Science curricula has the potential to prepare scientifically literate citizens, as a great percentage of Science teachers (75%) that were observed did not use the recommended strategies to deliver the content.

3. Questionnaires for students:

A large percentage of students do not really understand what is meant by SL. However, to some extent students know who a scientifically literate person is, as 76% of the respondents were able to define a scientifically literate person as one who is able to read and understand articles about science in the press and can engage in social conversations about validity of the scientific conclusions. When asked about what they can do after studying science in secondary school, only 47% of students responded that they can engage in social conversations about validity of the scientific conclusions. In conclusion, the implementation of Science curricula has very little potential to prepare the students to become scientifically literate citizens.

Conclusion

The SL themes in all the Science subject syllabuses are emphasized, in descending order, as such: Basic Knowledge of science (Theme I), Investigative nature of science (Theme II), science as a way of thinking (III) and Interaction of science, technology and society (Theme IV). Although the Theme IV is emphasized in all O’ level Science syllabuses, it is the least emphasized Theme in textbooks and is almost absent from some examination papers.

There is a big challenge in the implementation of what is intended to be achieved from the syllabuses because of poor pedagogies employed by teachers while teaching. It is important to align the textbooks to achieve the outcomes of the syllabuses and to have teacher guidelines to help teachers facilitate the learning process.

Generally, the Science curricula have reasonable potential to promote SL among O’ level school students. However, for the Science subjects to serve their purpose, equal emphasis should be placed on all SL themes. Careful monitoring of the implementation of the Science curricula is thus necessary.