PHYSICS AND CHEMISTRY FOR THE ENGLISH SECTION

2º , 3º AND 4º E.S.O.

INDICE

INTRODUCTION

Good science education is true to the child, true to life and true to science. This simple observation leads to the following basic criteria of validity of a science curriculum:

a) **Cognitive validity** requires that the content, process, language and pedagogical practices of the curriculum are age appropriate, and within the cognitive reach of the child.

b) **Content validity** requires that the curriculum must convey significant and correct scientific content. Simplification of content, which is necessary to adapt the curriculum to the cognitive and language level of the learner, must not be so trivialized as to convey something basically flawed and/or meaningless.

c) **Process validity** requires that the curriculum engage the learner in acquiring the methods and processes that lead to generation and validation of scientific knowledge, and nurture the natural curiosity and creativity of the child in science. Process validity is an important criterion since it helps the student in 'learning to learn' science.

d) **Historical validity** requires that science curriculum be informed by a historical perspective, enabling the learner to appreciate how the concepts of science evolve with time. It also helps the learner to view science as a social enterprise and to understand how social factors influence the development of science.

e) **Environmental validity** requires that science be placed in the wider context of the learner's environment, local and global, enabling him/her to appreciate the issues at the interface of science, technology and society and preparing him / her with the requisite knowledge and skills to enter the world of jobs.

f) **Ethical validity** requires that the curriculum promote the values of honesty, objectivity, co-operation, freedom from fear and prejudice, and develop in the learner a concern for life and preservation of environment

At the **secondary stage** the students should be engaged in learning science as a composite discipline, in working with hands and tools to design more advanced technological modules than at the upper primary stage, and in activities and analysis on issues surrounding environment and health.

Systematic experimentation as a tool to discover/verify theoretical principles, and working on locally significant projects involving science and technology are to be important parts of the curriculum at this stage.

Looking at the complex scenario of science education in Spain, three issues stand out very clearly. First, science education is still far from achieving the goal of equity enshrined in our constitution. Second, science education, even at its best, develops competence **but does not encourage inventiveness and creativity**. Third, the outdated methodology normally used in most schools to teach this subject does not help to motivate students towards continuing their studies on scientific topics, but all the way round.

The economic situation in the country, that has practically eliminated the possibility to have practical or laboratory lessons, due to the shortage of teachers, the obsolescence of material and the budget difficulties at secondary schools to effectively fund the maintenance of laboratories.

The implementation of the bilingual system in our schools is offering us an opportunity to overcome some of these difficulties, at least in its methodological aspects.

METHODOLOGY: CLIL

The CLIL strategy involves using a language that is not the student's native language as a medium of instruction and learning for subjects such as science, art, history or technologies. However, CLIL also calls on content teachers to teach some language.

Thus, CLIL is a tool for the teaching and learning of content and language. The essence of CLIL is integration. This integration has a dual focus:

a. Language learning is integrated in content classes. This means rearranging information in a way that facilitates understanding. When it comes to teach Physics and Chemistry, charts, graphs, diagrams and hands-on experiments are tools that fit perfectly into the CLIL strategies.
b. Content from subjects is used in language learning classes. The vocabulary, terminology and texts from those other subjects are incorporated in the language classes.

There is a third element that comes into play: the development of learning skills supports the achievement of content language goals. To summarize this, we could list the core features of CLIL methodology:

- Multiple focus
- Safe and enriching learning environment
- Authenticity
- Active learning
- Scaffolding.

THE LANGUAGE OF SCIENCE

Science subjects use language to describe, explain and analyze scientific phenomena. Science classes provide a lot of multimodal input that support understanding in a variety of ways. Using visual accompanying input, teachers can help learners to develop strategies to understand science. Learning about science, learners develop language for thinking skills such as reasoning, questioning, creative problem solving and evaluating. As the language becomes more challenging through the course, learners will become more skilled at expressing complex scientific ideas in a CALP way of expression, both speaking and writing. Examples of input in science that will be used throughout the lessons include the following:

- Teacher explanations, instructions and demonstrations
- Written scientific texts: articles, lab reports, instructions for experiments.
- Video or audio input: websites, scientific models, online games.
- Objects and models: laboratory equipment, chemicals, models of atoms and molecules.
- Hands-on work: experiments, fieldwork, demonstrations and visits to scientific museums.
- Visuals: pictures, photographs, models, diagrams, graphs and charts, the periodic table.

The language of science includes a variety of language functions, genres and text-types:

- It recounts- i.e. retells factual events in chronological order in laboratory reports; it uses past tenses, organizing words for time, the passive voice.

- It describes and informs- i.e. describes scientific phenomena, using factual information, technical language with no storyline; it explains characteristics; it uses long sentences with sub-clauses, numbering words, prepositions, ordering words, the language of comparison and contrast.

- It instructs- how to do experiments: it uses imperatives, question forms to check understanding of instructions, questions by learners to clarify understanding, linking words to number steps.

- It explains. How or why scientific processes work it uses the present tense to explain cause and effect, causal linking words, determining verbs, listing words, verbs to show conclusion.

- It persuades: attempts to convince someone of a point of view about a scientific issue; it uses numbering words, data to support arguments, the third person, linking words to build an argument.

- It discusses: presents reasoned arguments on scientific issues from different points of view, evaluates and gives opinions; uses tentative verbs, linking words for contrasting ideas.

- It predicts and hypothesizes: it uses future tenses, modals to predict, to emphasize tentativeness and to recommend, linking words for effects.

- It uses figures, symbols or abbreviations with few or no words.

- It uses abbreviations and symbols derived from Latin, Greek or English.

- It uses many technical terms, many Latin and Greek-based words, everyday words in specialist ways, words to describe concepts difficult to visualize, similar words with different meanings.

- It uses nouns instead of verbs and adjectives, long noun phrases and adjective phrases.

ACTIVITIES

In order to develop an effective CLIL methodology, the exposure to the second language above mentioned must be complemented by activities that focus on the integration of content and language and, although not being specific to the CLIL methodology, can improve the outcome in the students understanding of contents and apprehension of the second language.

The activities that will be implemented through this course in teaching Physics and Chemistry can be divided in 6 categories, and examples of them are listed as a guide to show what type of work is going to be done in the classroom:

1. Activating knowledge:
    a. Graphic organizers
    b. Guessing the lesson
    c. Hands-on discovering
    d. KWL grid
    e. Placemat
    f. Vital visuals
2. Guiding understanding
    a. Gist statements
    b. Graphic organizers
    c. Interactive Powerpoint
    d. Jumbles
    e. Mind the gap
    f. Understanding new words
3. Focus on language
    a. Guess the word
    b. Matching trios
    c. Mind maps
    d. Mnemonics
    e. Noticing
    f. Odd one out
    g. Word puzzle
4. Focus on speaking
    a. Describe and draw

b. Information gaps

c. Living graphs

d. Prove it

e. Speak for an audience

f. Think, Pair, Share

5. Focus on writing

a. Aliens

b. Focused free writing

c. Instructions

d. Questions to paragraph

e. Real-life writing

f. Storyboard

6. Assessment, review and feedback

a. Complete a rubric

b. Assessment questions

c. First person revision

d. Language feedback

e. Multiple intelligence: exploring

f. Visual assessments

GENERAL OBJECTIVES AND BASIC COMPETENCES

The objectives and basic competencies that are to be achieved at the end of the course are listed in the Spanish general syllabus design. For the English section, we can add the competencies that refer to the development of communication skills (Listening, reading, speaking and writing) as are stated in the English Department syllabus.

ASSESSMENT TOOLS

Just as students have different learning styles, different methods for assessing student's progress and understanding. Often, these methods are informal and ask the student to assess his or her own understanding of a topic. Classroom discussions in which students must answer questions or explain or summarize concepts are also mechanisms for informal assessment. Individual observation and register of students' performance during these activities are part of the final assessment on the subject and are to be taken into account in a reasonable proportion, for they are a basic part of the continuous assessment process.

This informal assessment is just a place to start. There are other assessment tools that will be used during this course and that can be categorized as follows:

Type of assessment	**Description**	**Where in program**
Derived assessment	Assessment is inferred from the student´s ability to respond to items on paper. Standard tests and quizzes	Test and quizzes, handouts questions, Unit reviews
Authentic assessment	Assessment is based on behavior, product or outcome. Notebook, projects.	Notebook revision, projects proposals.
Performance assessment	A kind of authentic assessment specific to Chemistry and Physics	Laboratory reports

Derived assessment: The questions and problems proposed in the different tests, quizzes, handouts… lead students through taxonomy of cognition from lower order thinking skills such as recalling information to higher order thinking skills such as synthesis or application. The following types of questions and problems reflect stages of development of understanding:

Practice questions and problems: test students' recall of new concepts.

Mastery questions and Problems: test the knowledge and comprehension of concepts through application to new problems.

Critical thinking questions: test the ability of students to analyze by requiring students of the thought process needed to relate concepts to hypothetical events in order to draw conclusions.

Cumulative Review: provides overlap that will enable students to synthesize concepts from every unit with previously learned concepts.

Challenge questions and problems: test the ability of students to synthesize concepts and apply them to unfamiliar situations.

Authentic assessment: The goal of this type of assessment is to make the means of assessing student progress consistent with the kind of situations that students will actually meet in real life, when they will be judged by the quality of their tangible production.

Performance assessment: This type of assessment is specially broken out in Lab Practicals that apply particularly to the techniques and processes of a chemistry or physics lab. Because demonstrations, activities and labs should be a cornerstone of the secondary school curriculum, Lab Practicals are bound separately from the other Authentic Assessment ideas.

GENERAL ASSESSMENT CRITERIA

Marking of derived assessment tools will take into account the following criteria :

a) Credit will be given to the proper resolution of the questions and problems , as well as to ordered and reasoned responses .

b) It will be negatively considered:

• Poor presentation

• Messed up solving of problems

• Avoidable mathematical errors

• Incongruent answers, absurd or without any physical or chemical meaning

• Absence of units in the results or erroneous units therein will be especially required , which can result in a minimum mark of the corresponding question.

The correction of tests and quizzes - especially the early – will serve , beyond marking, to show each student what are the most frequent causes of their failures and how to correct them. Department Teachers will always discuss corrected exercises with the students and clarify with them any questions that may arise.

To pass a final term assessment , in addition to obtaining the average score equal to or greater than five, will be necessary to obtain a grade equal to or greater than 3 on the assessment test .

The final grade of each assessment will be obtained considering written tests and quizzes as 70 % of the final mark , provided that the above condition is satisfied ,10 % will be an outcome from informal assessment during the lessons, another 10 % from authentic assessment and the final 10 % will come from performance assessment.

Chemical formulation is considered as an essential objective in this subject. Hence, a 75 % minimum performance will be required in specific formulation and naming tests and quizzes.

Recovery for students that are suspended in the various assessments are done through a written test after each term , in order to facilitate the keeping up of students . This test will be marked in the range 0-10 , and the new mark will include the rest of assessment tools above mentioned.

The final grade in this area will be the arithmetic mean of the marks obtained in the three terms , provided that each one is equal to or greater than 3 .

There will be an ordinary global test of minimum content at the end of the course for those students who have not passed the partial assessments for each term. Through it, students may show that they have the minimum knowledge and abilities required to pass the subject.

September Special testing will also test minimum contents . The final grade will be the grade obtained in this exam , regardless of laboratory skills and / or class work. The rating of this test will be complemented by the completion of a workbook which will be given to students who do not pass the matter in the ordinary call .

The mark of the booklet will be 20% of the grade obtained in this extraordinary call, and its presentation is considered a strict requirement to pass the subject, regardless of the students' performance in the exam.