



# WHOSE SKELETON IS THIS?

A grade 11-12 biology module on the anatomy of the human skeletal system

**Marco P. Ferretti**

Liceo Statale "E. Medi", Senigallia (AN), Italy

marcopeter.ferretti@istruzione.it



## Abstract

I present a grade 10-11 life science (biology) module, aimed at motivating students to learn the anatomy of the human body, implementing Cooperative Learning (CL) and Inquiry Based Learning (IBL) strategies. In this activity students investigate a simulated "crime scene", set up with plastic replicas of human skeletal elements. They examine the bones, take notes, document evidence and take pictures. The goal of the investigation is to attribute the skeletal remains to a specific individual (the "victim") from a list of five missing persons. To solve the "case", students need first to pose the right questions and then collaborate with each other in order to collect and analyze all the relevant data from the skeletal remains. Due to the popularity of such crime and investigation TV shows as "CSI", "NCIS", and "Bones", the proposed activity proved to be particularly attractive to young students, promoting their interest and motivation toward science learning.

## Introduction

Students motivation is a key aspect of modern teaching, Teachers need to implement strategies that invite the students to ask questions, to reflect on the phenomena and objects that surround them and to seek the means for obtaining answers. Only in this way it is possible to motivate the student to "want to know more", a fundamental prerequisite for an effective learning process (Holbrook, 2010).



Figure 1. Students checking growth chart to determine the skeletal age of the specimen.

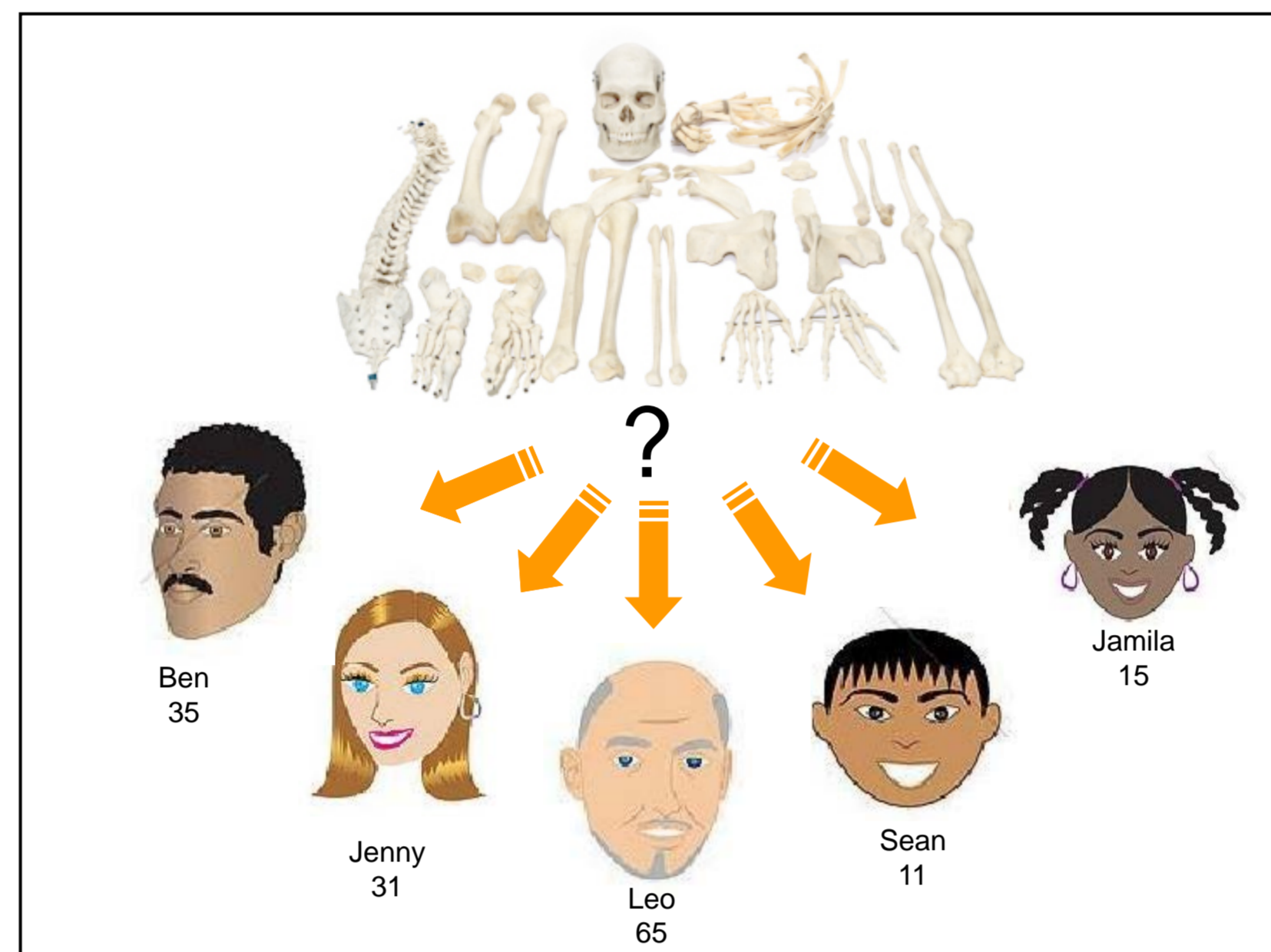


Figure 2. The five fictional "missing persons". The students-investigators must figure out to which of them the skeletal remains may belong.

## Materials and Methods

Teaching quality replica of human bones are used. A list of five fictional missing persons of different ages and sexes (Fig. 2) is prepared by the teacher. Each group of students is handed pre-printed cards for the collection of data (type of bone, side, size, etc.) and a form for the final report. To determine if the remains belong to more than one individual, students check if there are duplicated bones (e.g., two right humeri) or bones at very different developmental stages (e.g. immature, adult). The age of the individual to whom the remains pertained is estimated either from the stage of fusion of the epiphyses of the long bones (Fig. 3), from the fusion of the cranial sutures, or from the replacement and wear of the teeth. Finally, sex assesment is based either from the shape of the skull or, more reliably, from that of the pelvis.



Figure 3. Immature limb bones with open epiphyseal lines

## Conclusion

The purpose of this activity is three-fold:

First, to arouse a keen interest in the study of the anatomy of the human skeleton. Second, to allow students to experiment with the methods used in a scientific investigation, including the reporting of results. Third, through the simulation of a detective investigation, the activity is intended to make students understand how the "theory" learned in school applies to "real - life" situations. Most of the students involved in the activity found it interesting and challenging and somewhat funny. What they have enjoyed most was being able to find a way, scientifically valid and shared by all, to solve "the case". Last but not least, students involved in the "Bones" activity, earned on the average significantly higher examination grades than those who were taught the same content through a conventional lecture.

## Learning and competency expectations

The educational aims of the module are to develop the following skills in the students:

- 1) know how to make logical connections;
- 2) recognize or establish relationships;
- 3) classify and formulate hypotheses based on the data provided;
- 4) draw conclusions based on the results obtained and on the hypotheses that have been verified;
- 5) solve problematic situations using specific languages;
- 6) apply their knowledge to real life situations.

## The Module

The activity is divided into five steps.

**Step 1:** Case and evidence presentation by the teacher; initial discussion; definition of the key information that students must derive from the bones (num. of individuals; sex; age).

**Step 2:** Determination of the best methods (see Material and Methods) to get the information defined in step one; research from texts and online resources of the procedures to correctly apply the chosen methods.

**Step 3:** Acquisition from the teacher of background information on the anatomical features of the human skeleton and dentition, the manner of their development and maturation, and the differences between the female and the male skeleton.

**Step 4:** Analysis of the remains by groups of students (Fig. 1), each assigned to a different aspects of the investigation; production of a final report in which to specify the material analyzed, the method used to obtain the information sought (number of individuals / age / sex) and the conclusions.

**Step 5:** Presentation of the results obtained by each group, possibly through the use of multimedia presentations; final discussion and evaluation.

## References

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