Learning Guides: Tools to Mediate Student's Learning

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Context and outline

- The work to be presented here was developed during an in-service training action for teachers organized by the Polytechnic Institute of Braganca in partnership with the CFAE-Bragança (Centro de Formação de Associações de Escolas - Training center associated with school associations);
- The focus of the training was **“Experimental work in chemistry supported by the use of digital resources”**;
- The training action was organized in the context of the Chemistry is All Around Network project (http://chemistrynetwork.pixel-online.org/) and the objective was to involve teachers in the testing of digital teaching resources;
- A methodology based on the exploitation of a **learning guide** was used.

Context and outline

❑ The course was organized according to the following structure:

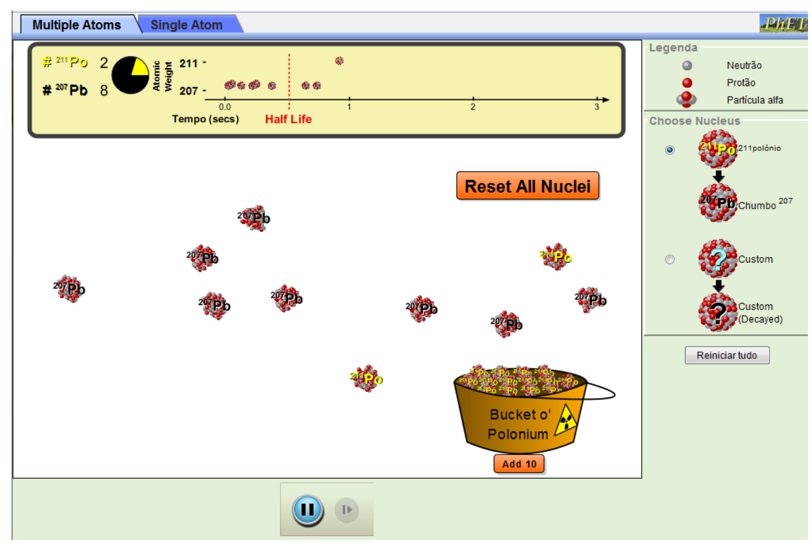
1. Learning the concepts for preparing and using a learning guide
2. Choosing a digital resource
3. Elaboration of a learning guide
4. Testing with students

Context and outline

- Some numbers (14 teachers, around 120 students, 7 digital resources):
  - ✓ Acid-base titration, Chemistry Companion Site, 11/e, Raymond Chang, William College, Kenneth Goldsby, Florida State University.
  - ✓ Electrochemical Series, Chemistry Experiment Simulations and Conceptual Computer
  - ✓ Periodic table of elements
  - ✓ Phet (Alpha decay, Beta decay)
  - ✓ Phet (Circuit Construction Kit, DC Only)
  - ✓ Phet (Energy Skate Park)

Context and outline

- Learning guides
  - ✓ What is a learning guide?
  - ✓ Why using a learning guide?
- Presentation of the case study (In this work the test of digital teaching resources using a learning guide, and related advantages, will be demonstrated with the case study **"Radioactivity: beta decay, alpha decay and radioactive dating** (http://phet.colorado.edu/)).
- Analyzing results



http://phet.colorado.edu/

Learning guides

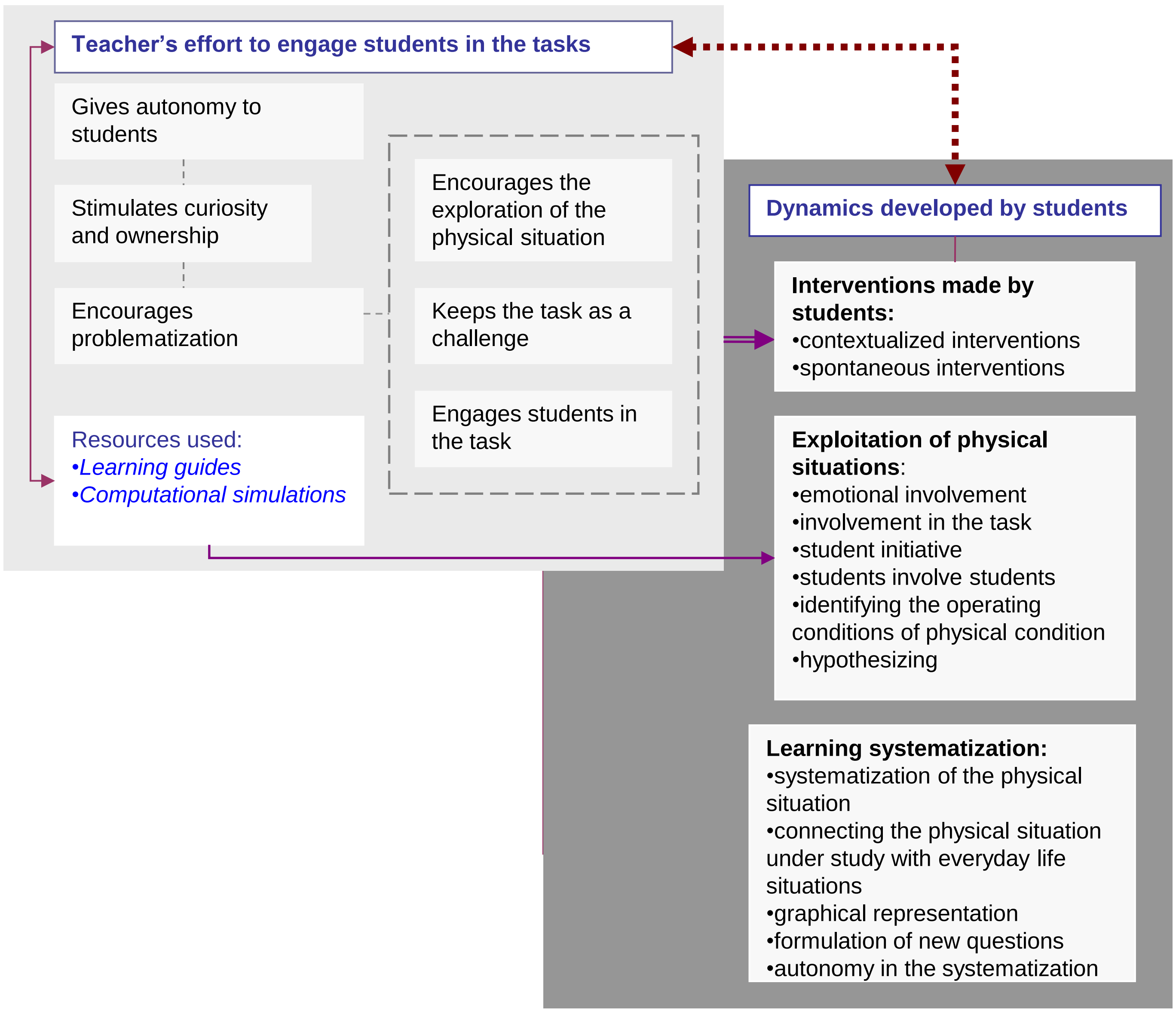
- Learning guides are mediation tools created to support software exploitation and guide students during their learning process by helping them to organize and structure knowledge in a global and transversal way.
- A learning guide is structured in the following parts:

✓ **Challenge-Tasks:** Guidelines are given and questions are formulated in the form of a challenge;

✓ **Testing:** Laboratory activities are proposed combined with the exploitation of the digital resources to be performed collaboratively (if adequate).

✓ **Knowing more:** The main objective of this final part is to stimulate students to value both skills and knowledge through its application to everyday life situations, therefore, attributing meaning and usefulness to scientific knowledge.

Learning guides



Learning guides

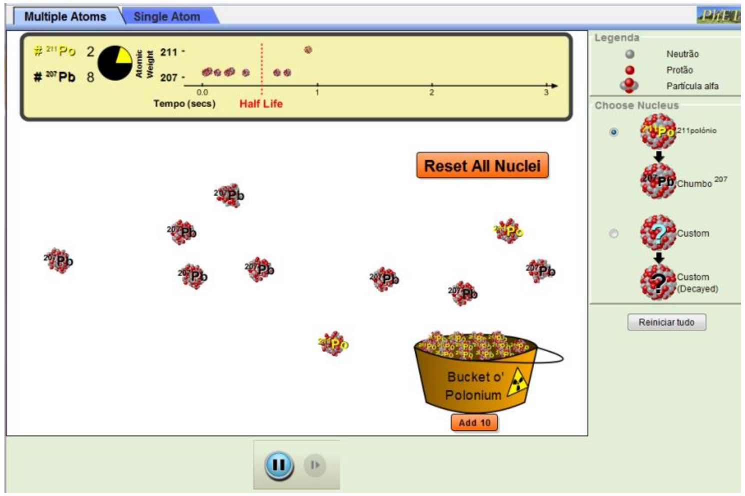
- In that way, students will use computers and educational software to interact with scientific models by changing data and variables, engaging in the exploitation of the physical situation, persisting in performing the task, showing initiative, taking control of their actions by making proposals, formulating new questions and managing to involve other students in task accomplishment and exploitation the situation.

Teachers preparing the learning guides.

Presentation of a case study

Title: Radioactivity: beta decay, alpha decay, radioactive dating

Digital resources: The tested digital resources where extracted from the portal Phet (http://phet.colorado.edu/).



- ✓ **<u>Alfa decay:</u>**

http://phet.colorado.edu/pt/simulation/alpha-decay

- ✓ **<u>Beta decay:</u>**

http://phet.colorado.edu/pt/simulation/beta-decay

- ✓ **<u>Radioactive dating game:</u>**

http://phet.colorado.edu/pt/simulation/radioactive-dating-game

Presentation of a case study

<u>**Objectives:**</u>

- ❑ Understand the concept of radioactivity;
- ❑ Identify radioactive isotopes;
- ❑ Schematically represent the radioactive decay of some nuclides;
- ❑ Determining the period of decay from the half-life time;
- ❑ Apply this knowledge to the dating of objects with hundreds or thousands of years.

Learning guide.pdf

ESCOLA SECUNDÁRIA/3 ABADE DE BAÇAL
Student's name:______________________________ Date: ____________
Professor's name:

LEARNING GUIDE

Learning objectives

- Understand the concept of radioactivity.
- Identify radioactive isotopes.
- Schematically represent the radioactive decay of some nuclides.
- Determining the period of decay from the half-life time.
- Apply this knowledge to the dating of objects with hundreds or thousands of years.

EXPERIENCE AND ANSWER THE FOLLOWING CHALLENGES

Challenge: How does the radioactive decay works?

To reply to this question, double-click on the following simulation:

Presentation of a case study

Information about the class:

- Escola Secundária/3 Abade de Baçal (Bragança, Portugal), upper secondary school, 12th year (17 years), Chemistry discipline (elective subject), with 17 students.

Strategy:

- The digital resource was explored by the students, following the instructions described in the learning guide;
- Students divided in groups of two elements per computer, explored the digital resource answering the challenges proposed in the learning guide;

Students testing digital resources

- Both students discuss the results as a group but each one gives an individual written answer.

Analyzing results

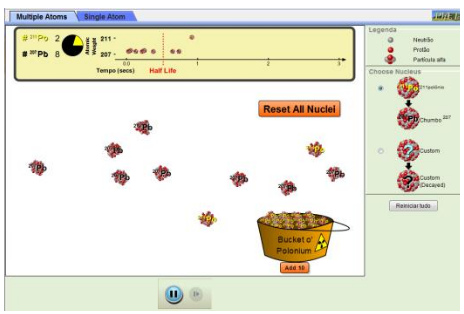
Students' learning progress was accessed based on a pre- and post-test and their comparison.

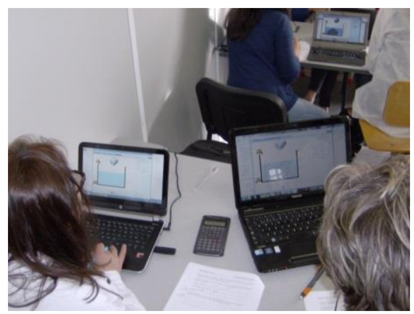
Some major evidences/conclusions:

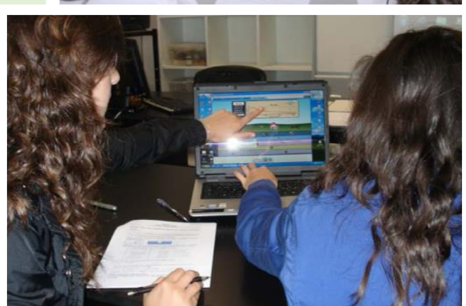
- ❑ The highest classification in the pre-test was 60% while in the post-test was 96%.
- ❑ The lowest grade in the pre-test was 30% while in the post-test was 58%.
- ❑ On the pre-test, the average grade of the class was negative (46.2%) - only 7 students were able to score higher than 50%.
- ❑ On the pos-test, twelve students scored marks higher than 70% and the class average increased to 80.9%.
- ❑ The normalized gains calculated through the comparison of both pre- and post-test demonstrate a high conceptual gain: 0.64.

Conclusions

- Digital resources constitute powerful tools available for scientific exploitation that must be mediated by the teacher and Learning Guides to propitiate significant learning.
- *The combination of interactive digital tools with laboratory work can improve the classroom environment and the quality of student learning.*







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THANK YOU!



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