

# Attitudes, expectations, and practices in the portuguese secondary schools’ science laboratories

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## Summary

### THE PORTUGUESE SECONDARY SCHOOLS’ MODERNISATION PLAN

The current plan for the modernisation of the portuguese secondary schools’ buildings, the sixth of this size since the beginning of the twentieth century (Alegre, 2009), established a new school building model with a priority intervention in the so called Center for Science and Technology. The new model of schools’ science spaces included in this Center aims to support a variety of teaching strategies, linking theory and practice (Parque Escolar EPE, 2009), aligning itself with the principles of the reform of secondary education and science curricula in particular (Ministry of Education, 2003; Jordão et al., 2006). **This model has already been applied to 106 schools across the country.**

### THE PREVIOUS MODEL OF SCHOOLS’ SCIENCE SPACES

Unlike the anglo-american model of science learning spaces, formalised in a single laboratory for all classes with daily activities of observation and / or experimentation, the portuguese previous model included both “traditional” classrooms for lectures and laboratories for practical work, mostly for students in the final years of secondary education, with older schools also including amphitheatres for teacher-led demonstrations. This separation of spaces corresponds to a separation of teaching strategies, with the classroom devoted mainly to instruction and problem solving, and the laboratory to practical work, close to its origins in the university model of science teaching in the nineteenth century.

### THE NEW MODEL OF SCHOOLS’ SCIENCE SPACES - THE SCIENCE LEARNING STUDIO

**This bipartite model contrasts with the new model, in line with the learning studios and classrooms / environments for active learning, a hybrid space to support instruction, practical work and other teaching and learning activities, to which we would like to refer to as Science Learning Studio.**

### THE RESEARCH PROJECT (2013-2015)

Taking advantage of the opportunity offered by the modernisation plan and our involvement as the team that defined the model, along with the emergence of a recent area of research on active learning environments for scientific subjects (Beichner et al., 2007; Brooks, 2010; Dori & Belcher, 2005; Kohl & Kuo, 2009; Whiteside et al., 2010), this poster presents an overview of an **ongoing research project** that intends to identify the meanings attributed by teachers to the science learning studios and their use, analyse teaching and learning activities in the new science learning studios, inquire about the current situation of instructional, practical and project-based activities in these new spaces and develop exemplary science departments..

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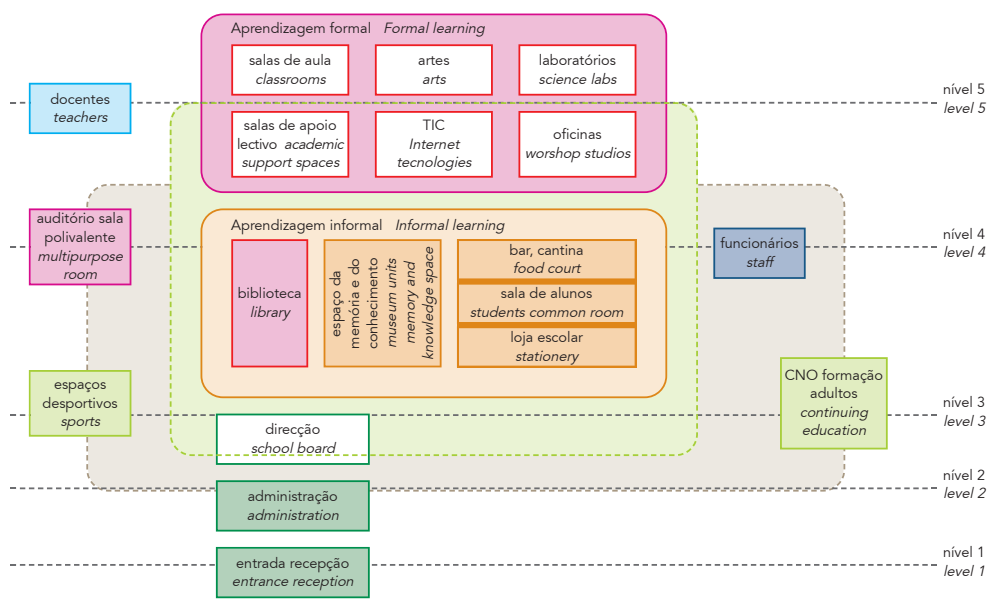


Fig. 1 - Parque Escolar’s publication of the intervention in 106 schools (top) and levels of functional hierarchy of the schools’ intervention (above)



Fig. 2 - Laboratories and regular science classrooms before (left) and after the modernisation plan (right)

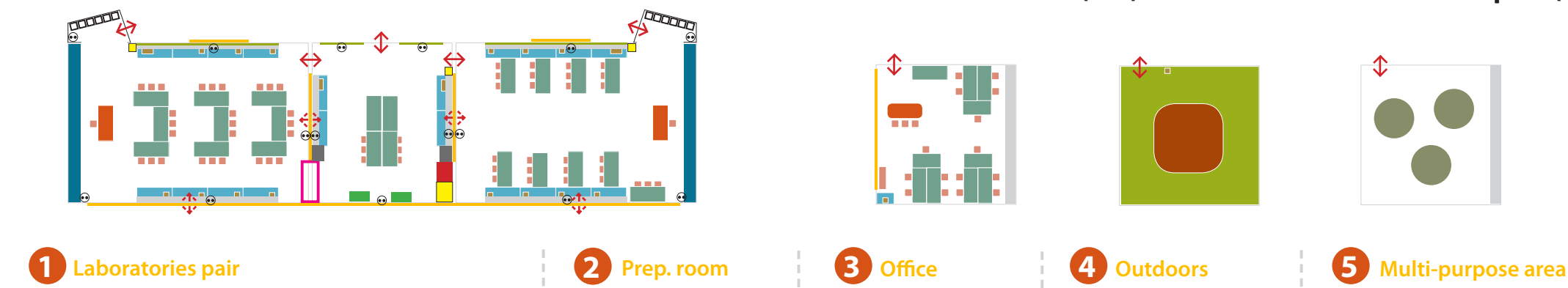


Fig. 3 - Structural units of the science spaces model

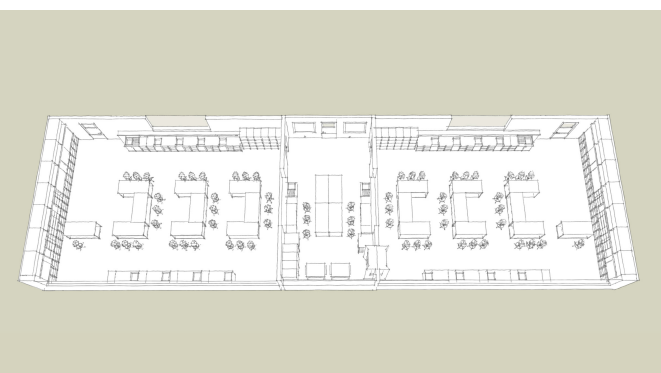
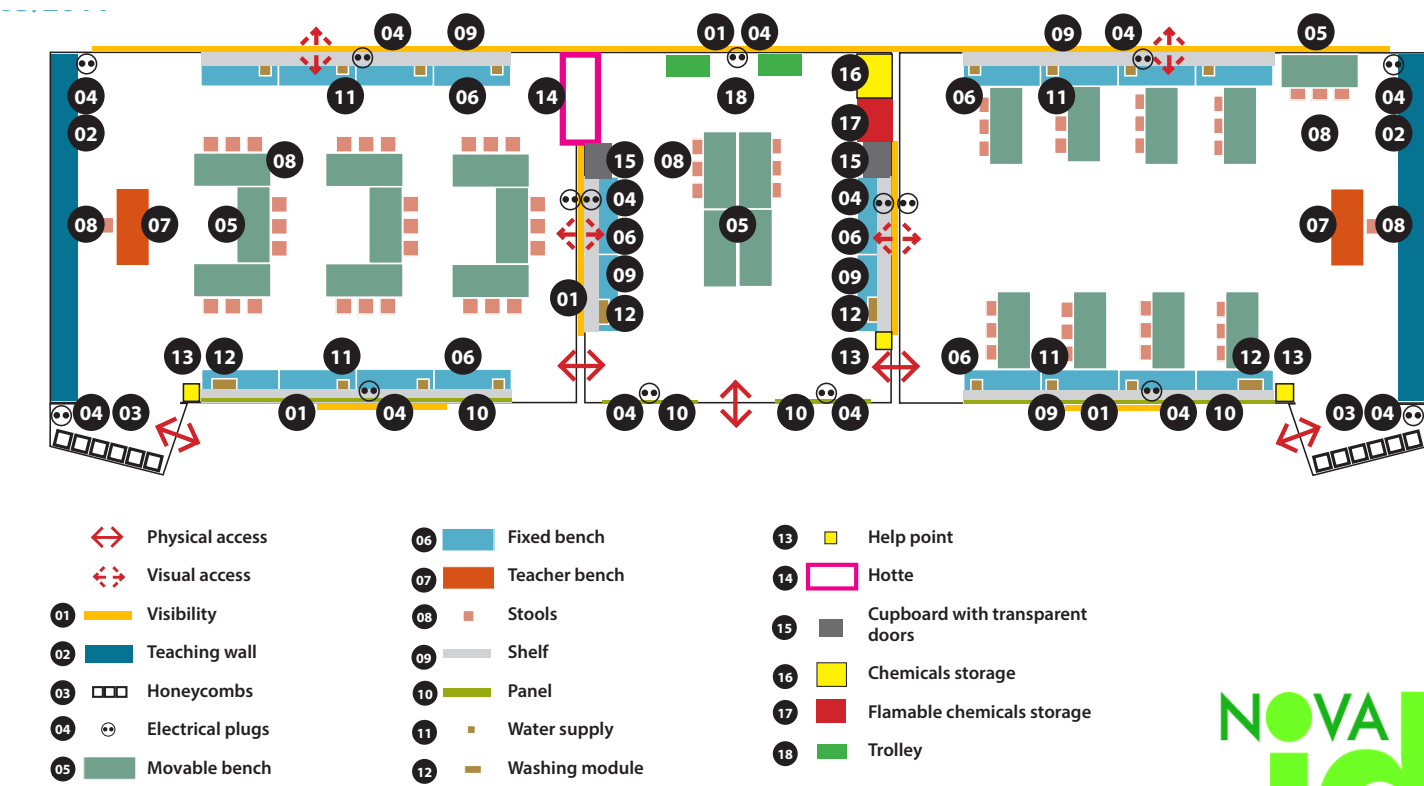


Fig. 4 - Detail on the laboratories pair and prep. room (left) and its 3D model (right)

## Literature Review

The literature review will look at several fields, mainly Ethics, Semiotics, Ontology, Epistemology, mainly from Cognition, Learning Sciences and Science and Technology Studies and Sociology of Scientific Knowledge, Scientific Literacy, Learning Environments, Active Learning Environments/ Classrooms, and several national studies concerned with teaching and learning activities in school science, in particular the White Paper of Physics and Chemistry. Systemic-Structural Activity Theory (SSAT) will constitute a theoretical framework for the overall research design.

## Timeline

Task number and concentration	Year 1	Year 2
m1-2	m3-4	m5-6
m7-8	m9-10	m11-12
m13-14	m15-16	m17-18
m19-20	m21-22	m23-24
<b>Task 1. Literature review</b>		
A. Identification and selection of relevant studies about active learning environments and related themes		
B. Synthesis of the literature review		
C. Report and paper writing and dissemination		
<b>Task 2. Survey</b>		
A. Inquiry process definition		
B. Questionnaire development and validation		
C. Field work		
D. Results synthesis and analysis		
E. Report and paper writing and dissemination		
<b>Task 3. Case studies</b>		
A. Inquiry process definition		
B. Interview and focus groups methodology planning and dev. of obs. schedule		
C. Pilot study		
D. Field work		
E. Results synthesis and analysis		
F. Report and paper writing and dissemination		
<b>Task 4. Exemplary science departments and teacher training programme development</b>		
A. Selection of sites and development process definition		
B. Development work		
C. Report and paper writing and dissemination		
m1-2	m3-4	m5-6
m7-8	m9-10	m11-12
m13-14	m15-16	m17-18
m19-20	m21-22	m23-24
Year 1		
Year 2		

## Methods

Data gathered in previous ethnographic research work in two schools will serve as a pilot to produce some of the illustrations of activities in the science learning studios.

### CASE STUDIES

Later, **eight case studies** will take place in schools across the country. The selected schools and teachers will be defined with the support of an expert in the field, and will consider (1) the location (in all of Parque Escolar’s subsidiaries across the country), (2) exemplary teaching and learning activities defined according to a proposed Science Learning Studio’s Pedagogical Methodology (3) common teaching and learning activities identified in the literature (4) the presence of theory, practical and project based classes taught by science teachers (5) the schools’ and teachers’ availability and (5) the use of the science learning studios for at least one school year.

Selection of data and observation of activity in the spaces will be carried using the proposed **Science Learning Studio Activity Analysis Methodology**, in theory and practical science classes and project-based classes tutored by science teachers. **Graphic novels** will also be used to illustrate the activities in the science learning studios.

### COGNITIVE WALKTHROUGH INTERVIEWS

A **Cognitive Walkthrough Interview Schedule** (CWIS) will guide the interview process, designed to look with further detail at the common and exemplary activities in the science learning studios, providing a spatial agenda for participants to respond to. This schedule will also try to identify the needs of teachers, laboratory technicians and heads of science facilities regarding the organisation, management and use of the new science learning studio in these activities. Interviews will be documented with notes, photographs and audio/video recordings.

### SURVEY

A **digital survey**, with a pre-pilot and identification and itemizing of subsidiary topics, will be made with inputs from the White book of Physics and Chemistry and from the literature review, influenced by SSAT and its conceptualization of human activity. The population to which the survey will be addressed will be all the secondary science teachers in all of the schools (106) involved in the modernisation plan.

### CO-DESIGN SESSIONS

**Co-design sessions** with the science departments involved in the case studies will take place, both in schools and online, to develop an online course structure and materials to support the organisation, management and use of the science learning studios. Besides this, four schools with outstanding work in this themes will be supported to **develop exemplary science facilities as role models for the remaining schools of the modernisation plan.**

## Research questions

**RQ1.** What attitudes and expectations do teachers and students have towards the new science learning studios?

**RQ 1.1.** What elements of the new model are more and less valued? Why?

**RQ 1.2.** How do teachers and students compare the new model with the previous models available in schools?

**RQ 2.** What teaching and learning activities are taking place in the new science learning studios?

**RQ 2.1.** To what extent, if any, does the new model facilitate or inhibit these activities?

**RQ 2.2.** What are teachers and students perceived needs regarding the organisation, management and use of the new science learning studios?

**RQ 2.3.** How do these activities contrast with previous data from the White Book of Physics and Chemistry?

**RQ 3.** What are the differences between the idealised and the applied science learning studios model in the intervened schools?

## Pedagogical novels

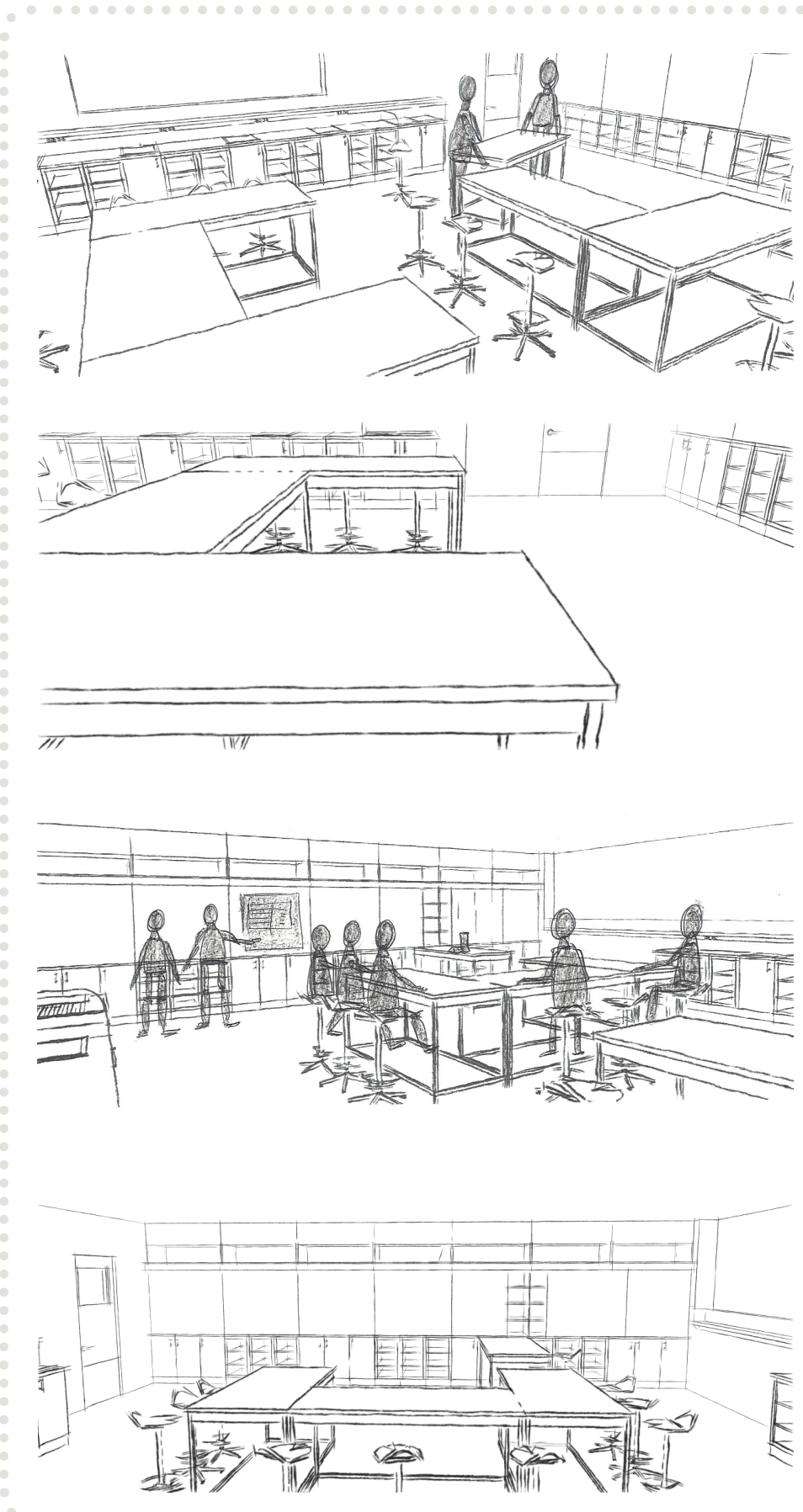


Fig. 5 - Illustrated novels

## Goals

**A.** Extend the field of active learning environments research to secondary education

**B.** Inform the improvement of the model of the science learning studios

**C.** Identify teachers’ meanings attributed to the science learning studios and their practices

**D.** Analyse teaching and learning activities in the science learning studios

## Outcomes

**A.** A Science Learning Studio Pedagogical Methodology (SLSPM)

**B.** A Science Learning Studio Activity Analysis Inventory (SLSAAI) to analyse activities in the science learning studios

**C.** Exemplary Science Learning Studios Activities as Graphic Novels

**D.** Exemplary Science Departments

**E.** A website for national outreach:

**http://laboratoriosescolares.net**

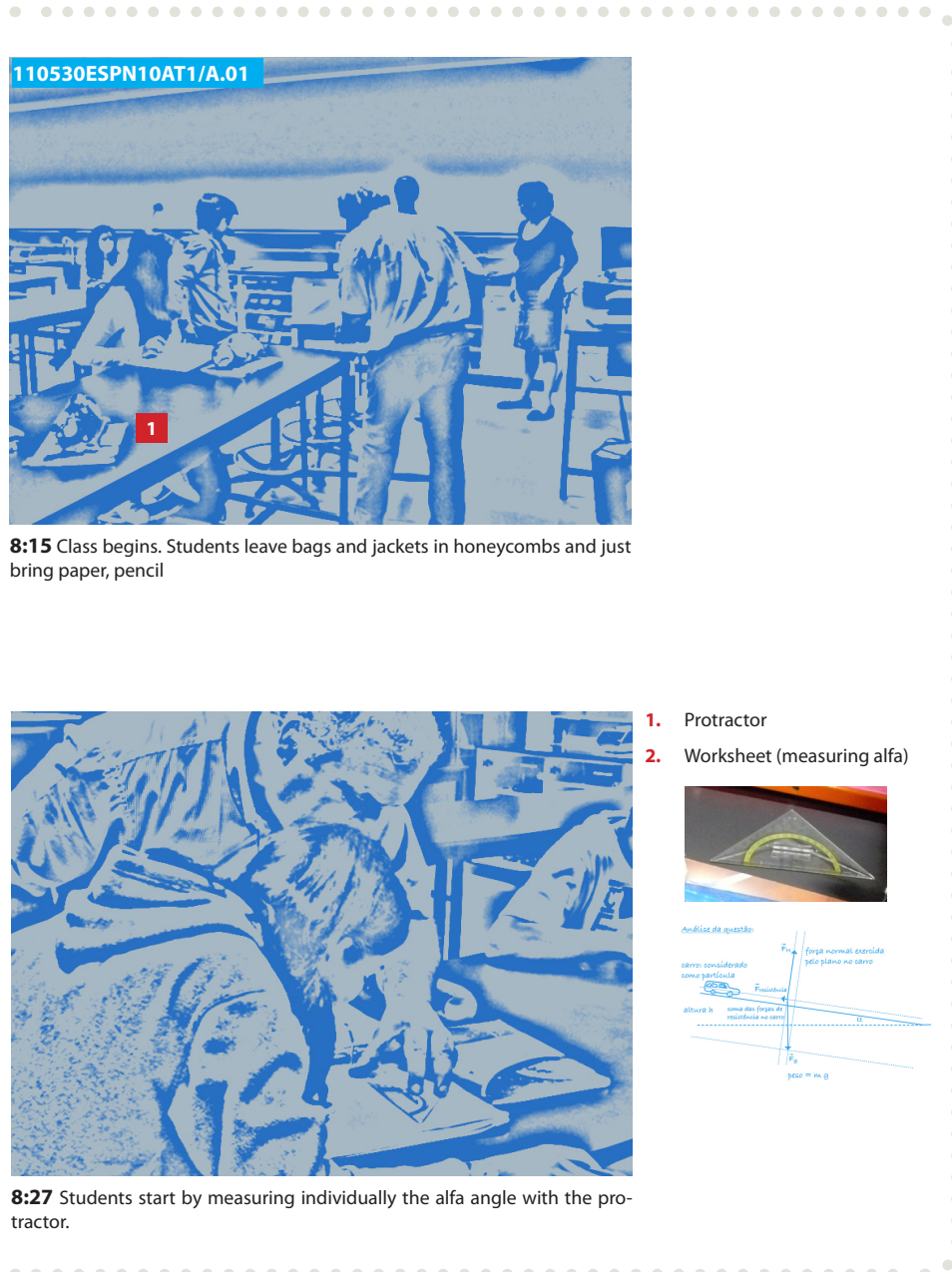


Fig. 6 - Photonovel

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