

# Designing Pedagogical Graphic Novels as Tools for Educational Research, Practice and Professional Development?

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## Introduction



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2. Team member of the project “Attitudes, expectations and practices in the Portuguese secondary schools’ science laboratories”, funded by the Portuguese national science foundation;
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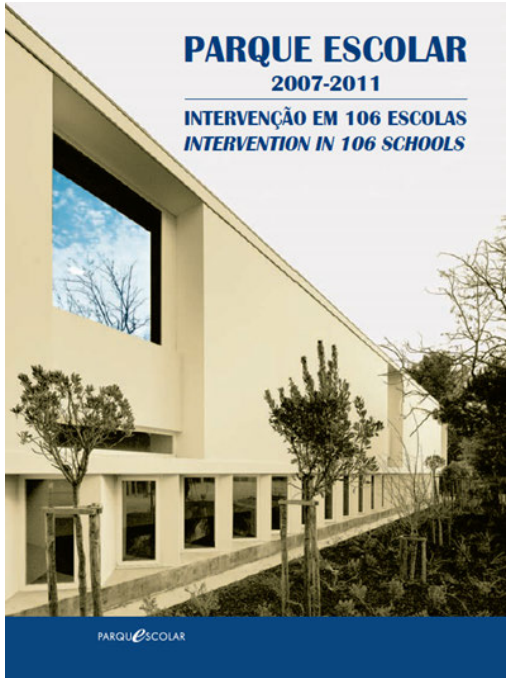
1. Independent researcher
  - a. Educational research
  - b. Participatory research methods
2. Teacher trainer

## Advanced organiser

1. Context
2. First steps in the development of the concept of pedagogical graphic novel
3. The ongoing research project and further development of the concept
4. A tentative definition
5. Foreseeable applications
6. Some literature we have been looking at to inform development
7. Questions to and from the audience

# Context

## The Portuguese secondary schools' rebuilding programme (2007-2011)



## The new model for schools science learning spaces (the science learning studio)

### STRUCTURING UNITS 5 essential spaces

The proposed concept includes 5 essential spaces for the various activities related to the teaching and learning of Science, or more broadly, to school activities.





### **Teacher training: Using the new science laboratories**

1. Took place in 2010, in 4 regions in Portugal, to 110 teachers using the new laboratories
2. One of the goals: to design activities that promoted active learning, aligned with the view on teaching and learning of the new spaces
3. One of the proposed activities required trainees to produce a photographed protocol of a practical activity, to later be used in classes with students, so that they could infer the procedure and the materials involved, providing prompts with perceptual fidelity to support inquiry practices that coordinated the domain of objects and observables and the domain of ideas (Millar, 2010)

## First steps

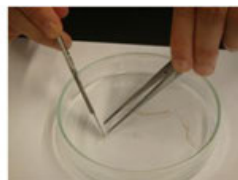
### Atividade Laboratorial – Biologia 11º

#### 2- Procedimento

2.1- Coloque nove gotas deorceína acética e uma gota de solução de ácido clorídrico (solução a 5%) num vidro de relógio.



2.2- Coloque três extremidades de raízes de cebola, com cerca de 3 mm de comprimento, na mistura anterior. Aguarde 5 minutos.



2.3- Aqueça à chama da lamparina até que se libertem vapores. Não deixe ferver.



To better communicate to teachers the dynamics of this kind of activity, after a photographic recording of a class in the new spaces, photos were combined with a brief explanation of the represented activities, in a format close to the storyboard.



A preparação demora o tempo adequado e exige a verificação pela professora...



Uma vez verificado o protocolo e os cálculos, os alunos seleccionam o material a utilizar...



1. Lego car
2. Worksheet



8.25 Teacher takes lego car from transparent box and asks who knows how to play with legos.



1. Lego car
2. Worksheet
3. Student's notebook



8.25 Teacher asks student that read to illustrate what she read in the worksheet A using the lego car and her notebook as a ramp.

With the goal of extending the same rationale to other activities not essentially practical, and to facilitate the production and dissemination of these storyboards, a class was photographed and the photos were processed with filters to anonymise the participants, and later composed graphically, adding another layer of information about the dynamics of participants and objects.

## Ongoing research project

### Research questions

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

**RQ1.1.** 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?

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

<http://laboratorioscolares.net>



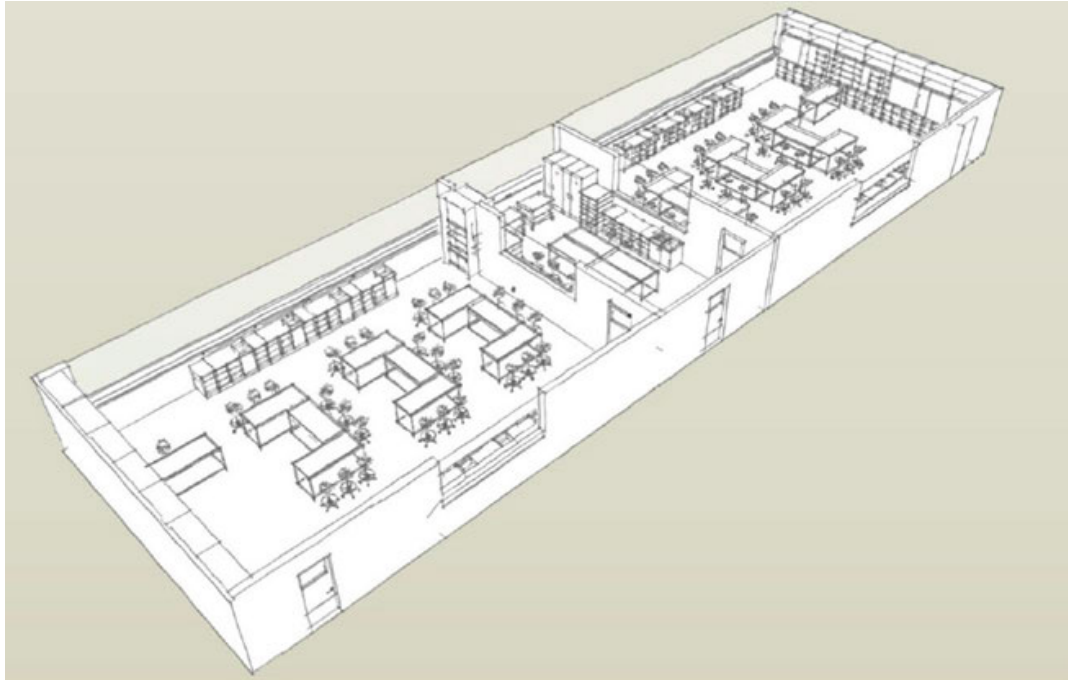


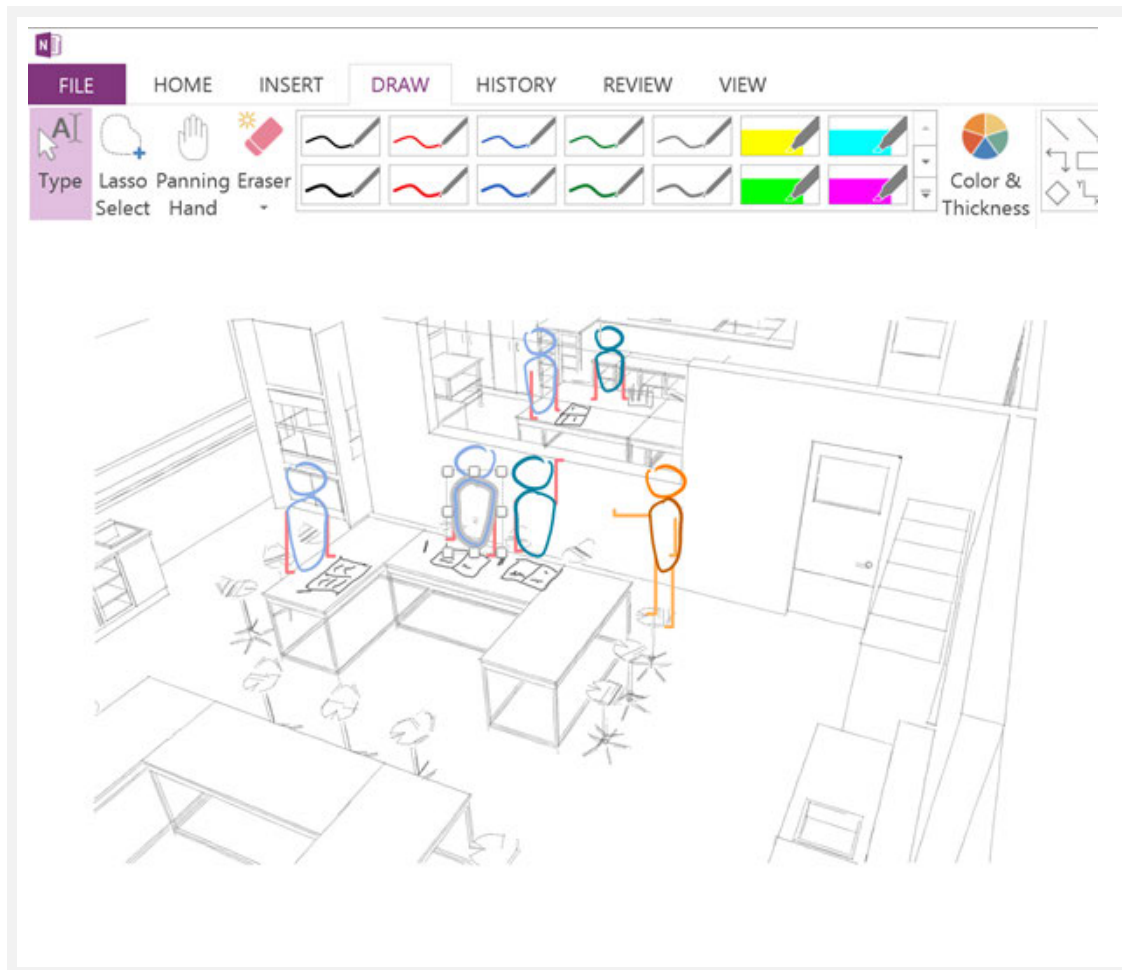
[http://laboratorioscolares.net/research/research\\_project\\_poster.pdf](http://laboratorioscolares.net/research/research_project_poster.pdf)

**Three tasks in the project:**

1. Survey
2. Case studies
3. Development of exemplary science departments

The workflow for illustrated novels: A 3D model in Google Sketchup of the new science laboratories allows to export images of the selected scenarios...





...that are illustrated over, using OneNote.

These were integrated in a survey to teachers teaching in the new laboratories.

D. Alunos em trabalho autónomo na SALA DE APOIO no decorrer de uma actividade no laboratório



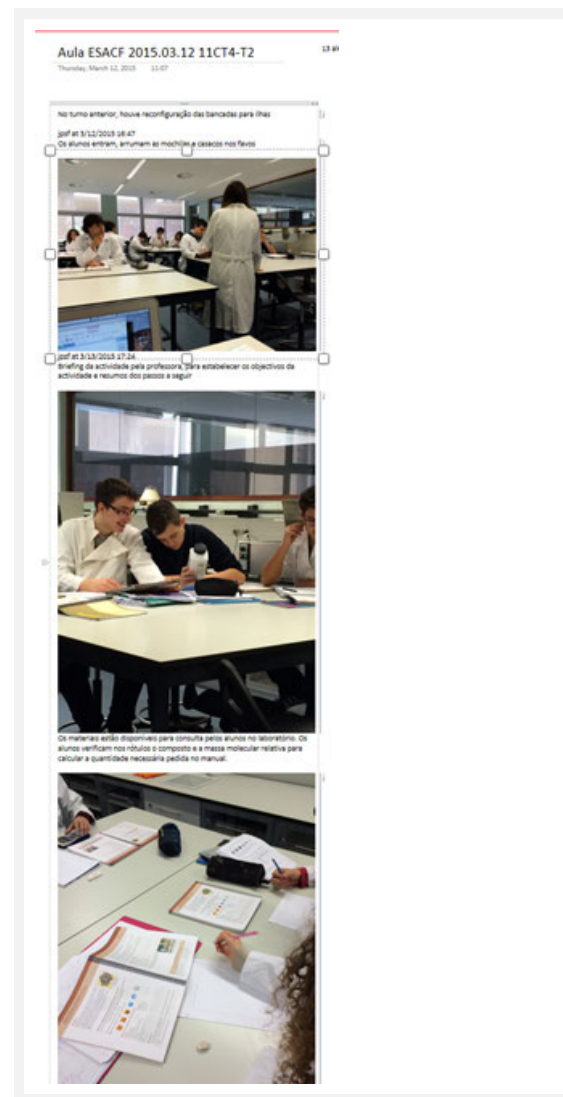
O professor acompanha a actividade dos alunos no laboratório, podendo ao mesmo tempo observar alunos em trabalho autónomo através da transparência para a sala de apoio.

O professor também pode estar na sala de apoio e manter contacto visual com a turma.

21. Esta característica ("transparência para a sala de apoio") está presente nos novos laboratórios?

- Sim
- Não
- Parcialmente
- Não tenho a certeza

The workflow for photo novels: photos are captured and short comments are added with a mobile device into OneNote during classroom observation ...



.. and then photos are cropped and comments are reviewed and extended with the teacher using an activity analysis methodology.

Cropped Aula ESACF 2015.03.12 11CT4-T2 13 alunos, 4 ilhas, 4 grupos

Thursday, March 12, 2015 11:07

No turno anterior, houve reconfiguração das bancadas para ilhas

jsrf at 3/12/2015 16:47

Os alunos entram, arrumam as mochilas e casacos nos faveiros



jsrf at 3/13/2015 17:24

Briefing da actividade pela professora, para estabelecer os objectivos da actividade e resumos dos passos a seguir



Os materiais estão disponíveis para consulta pelos alunos no laboratório. Os alunos verificam nos rótulos o composto e a massa molecular relativa para calcular a quantidade necessária pedida no manual.



jsrf at 3/12/2015 16:48

Grupo consulta o protocolo no manual e na ficha fornecida na aula anterior (fotocópia de manual antigo)


Later, photos and text are composed in OneNote using a template developed by the authors (graphic novel)...


**Aula**  
03 May 2015 13:50


**APL 1.2**  
**Síntese do sulfato de tetraminocobre (II) monohidratado**  
Escola Secundária António Carvalho Figueiredo, FQ11 CT4, Turno 1, 2015.03.12 11:20-13:45, ESACF, FQ11 CT4-T1 2015.03.12 APL 1.2


Info genérica sobre a aula, n.º de alunos, configuração das bancadas, sumário, etc.


**A. Introdução da actividade e preparação de fluxograma**


**01.**  
  
Os alunos entram, colocam as mochilas, casacos e capacetes nos favos e reorganizam as bancadas em 3 filas.

**02.**  
  
A professora introduz a actividade laboratorial ao grande grupo, estabelecendo os objectivos num organizador avançado.

**03.**  
  
Os materiais estão disponíveis para consulta pelos alunos no laboratório. Os alunos verificam nos rótulos o composto e a massa molecular relativa para calcular a quantidade necessária pedida no manual.

**04.**  
  
Grupo consulta o protocolo no manual e na ficha fornecida na aula anterior (fotocópia de manual antigo).

**05.**  
  
fazendo o cálculo da massa de  $\text{CuSO}_4$  (hidratado) necessária para a preparação da solução exigida, tendo em conta o valor da massa atómica dos elementos do composto na tabela periódica.

**06.**  
  
Professora esclarece algumas dúvidas e chama a atenção para erros comuns (perdas nas transferências afectam o rendimento p.e.)

... and eventually exported as Word for further commenting, page numbering, post-production and distribution in PDF format.

ESACF FQ11 CT4-T1 2015.03.12 APL 1.2.pdf - Adobe Reader

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Page Thumbnails

ESACF FQ11 CT4-T1 2015.03.12 APL 1.2  
03 May 2015  
13:50

APL  
**Síntese do sulfato de tetraminocobre (II) monohidratado**  
ddd

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06. Professora esclarece algumas dúvidas e chama a atenção para erros comuns (perdas nas transferências afectam o rendimento p.e.)

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## A tentative definition

We revised the conceptual frame of the storyboard concept and thought it would be best approached as pedagogical graphic novels: pedagogical due to its focus on teaching and learning activities; graphic due to its perceptual fidelity to the activity; and novel due to its conceptualisation by Bakhtin (1982; 1990) as a literary genre that is adaptable due to its lack of canon and that affords an aesthetical, dialogical relation between the author and its hero.

*Pedagogical graphic novels are representations of teaching and learning activities with a certain degree of perceptual fidelity, real or imagined, that make explicit the pedagogical rationale, the trajectory and the results of the said activities.*

## Foreseeable applications

1. For researchers, peers and teacher trainers and educators to record and analyse what is happening in the science learning studio;
  1. Graphic novels of real activity, combined with audio/video recording and transcribing
2. For researchers to communicate research based pedagogies;
  1. Classroom simulations using illustrated novels
3. For teachers to record their classes as practitioners, providing opportunities for reflective practice and improvement if used in that sense;
4. For teachers and students to use them in teaching and learning activities
  1. As a lab worksheet for students to create the protocol
  2. Collaborative graphic novel of the class, with students

### Next steps

Test these applications in the next school year – a new year 10 physics and chemistry curriculum

## The literature we've been looking at

Taking as ground (Systemic Structural Activity Theory) as a theoretical framework for human activity (Bednyĭ & Karwowski, 2007) we are now looking fields such as:

1. Innovation theories (Akrich et al., 2002), which acknowledge the non-linear and dialogic socio-material aspects of technological change;
2. Design theory that proposes the production of digital objects with multiple affordances and coordinating features through a perspective of "design after design" engaging the user as a designer in use (Björgvinsson et al., 2012), through concepts of boundary objects and infrastructuring (Star & Ruhleder, 1996);
3. cognitive sciences literature for more multimodal, dynamic and material approaches to cognition, around concepts as grounded cognition (Barsalou, 2008), epistemic action (Magnani, 2005);
4. Peircean Semiotics looking for ways of addressing manipulation and simulation through iconic semiosis (Ata & Queiroz, 2013) and abduction (Paavola, 2005).

## Questions to the audience

1. Does this type of representation make any sense to you?
2. What do you think of the tentative definition? And the chosen name of “pedagogical graphic novels”?
3. The workflow to create the photo and illustrated novels, does it seem too sophisticated or manageable?
4. Are we being naive in the foreseeable applications for this?
5. What should we be concerned with in the testing of applications in the next school year?
6. What theoretical frameworks do you think can improve our work on this?

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