Collaborative Aspects of the WGL Project

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Abstract

We intend to build a Web Geometry Laboratory (WGL) system that allows the teacher to create, store and provide a set of geometric constructions to its students.

The student are able to access the professor's constructions and download them into a personal *scrapbook*.

The groups of students are then able to work collaboratively, seeing and exchanging each other constructions.

The Web-based WGL environment aims to become a learning environment to be used during classes and also outside the classroom with DGS and GATP integration [Santos and Quaresma, 2012].

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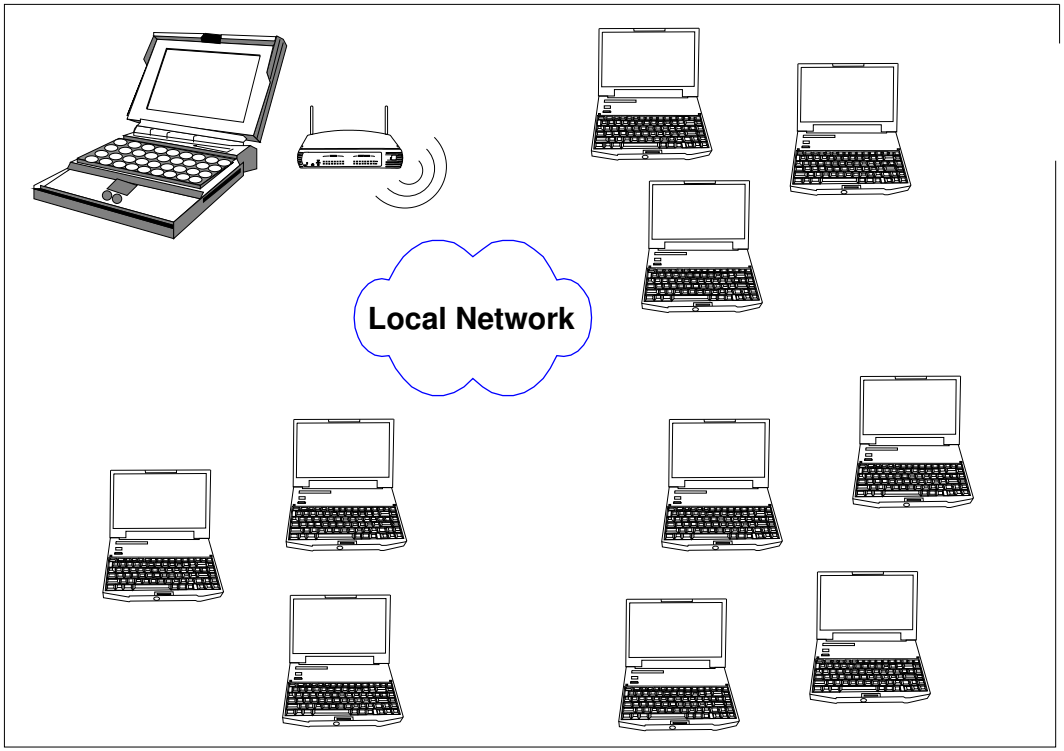
Blended-Learning Web Environment

WGL – in the classroom



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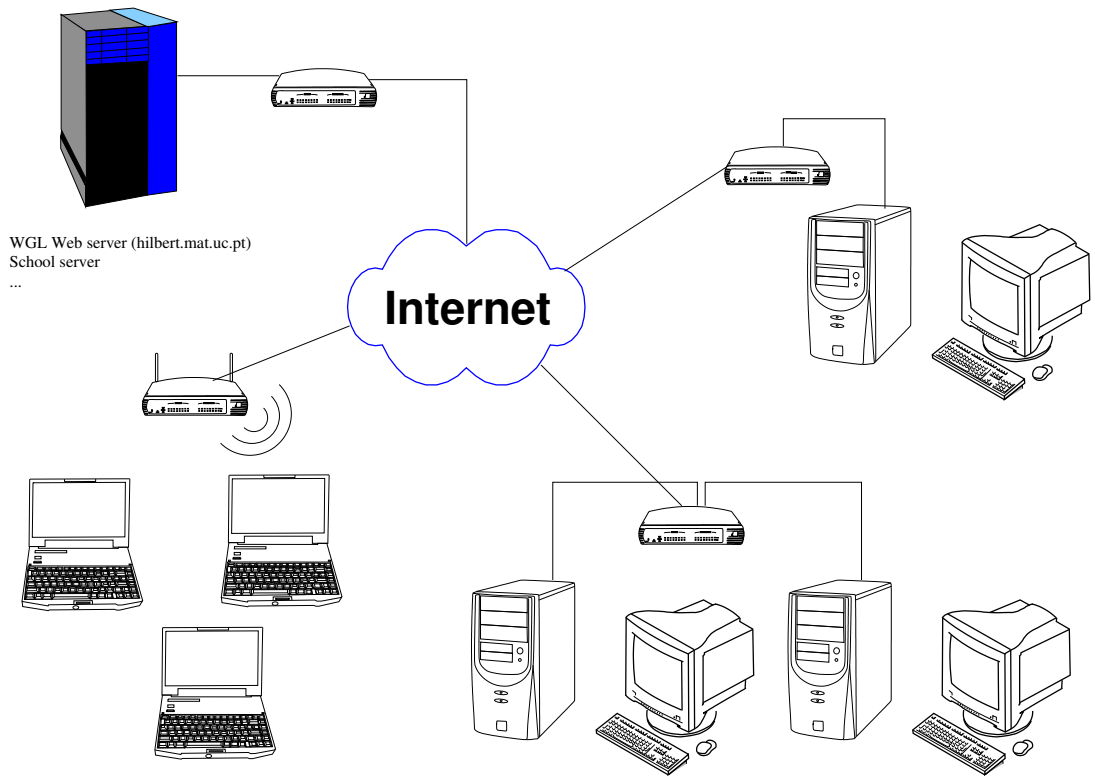
WGL – outside the classroom



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It is intended that the student has continued support, or support in their homework.

Collaborative Learning

"Learning is a highly interactive and dynamic process." [Wang, 2010]

"Constructivism provides a theoretical framework for collaborative learning, where learners are put at the centre of the learning process to create their own knowledge through conversations." [Wei and Ismail, 2010]

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- is a natural social act in which students talk among themselves;
- students help and encourage each other to learn, it involves a considerable interaction.

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In our case, the possibility for the student to exchange/merge their geometric constructions

WGL in Classroom

The geometry is being used as a means for describing, understand and interact with the space we live in being seen as the most intuitive part of mathematics, and related to concrete reality.

The dynamic geometry software allows the composition of geometric specification of free objects and objects obtained by construction using a set of steps that implement the basic constructions.

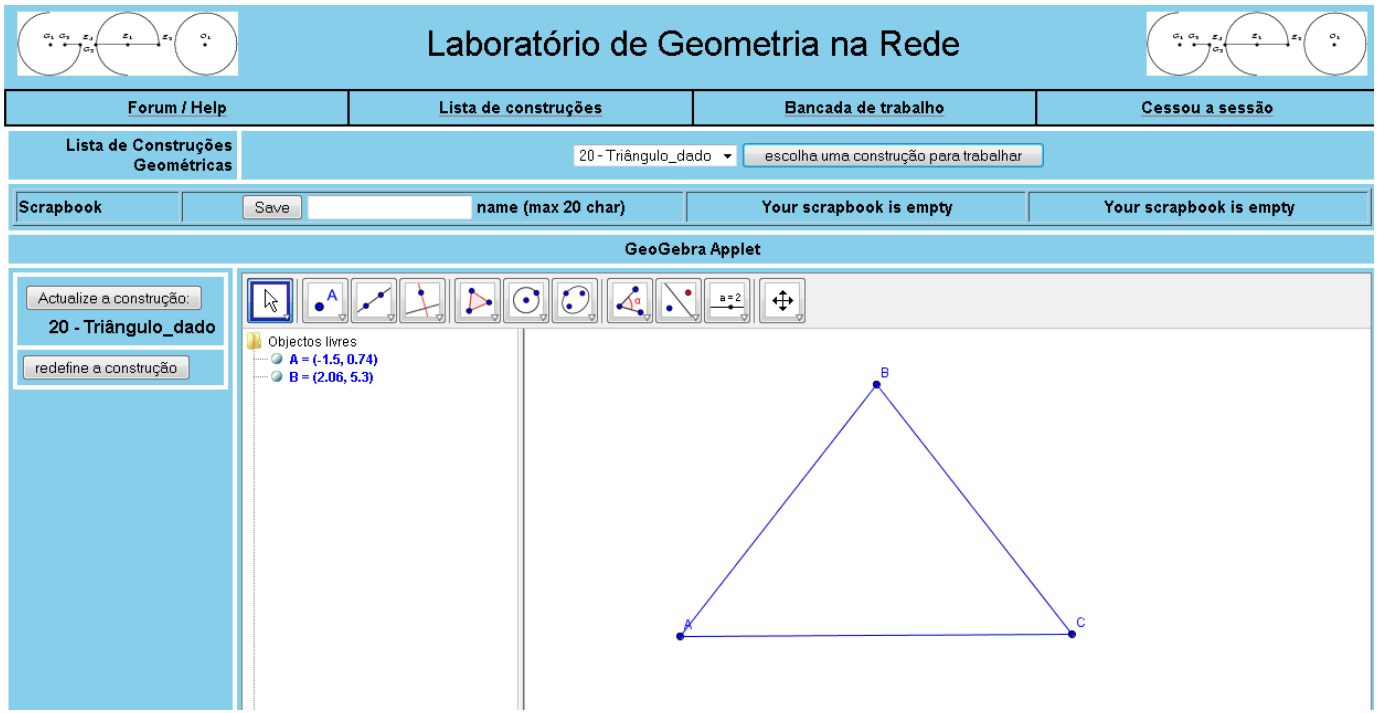
WGL in Classroom

Generic steps of the construction:

1. Choose the tool "Polygon" at the tool bar.
2. With the tool "Perpendicular Bisector" construct the bisectors of all sides of the triangle.
3. To find the intersection of perpendicular bisectors use the tool "Intersects two objects".
4. To finalize the construction use the tool "Circle with Center through a Point".

WGL in Classroom

We have the following example, which the teacher provides a triangle for the construction of circumcenter:



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The calculation of the point intersection of bisectors of a triangle.

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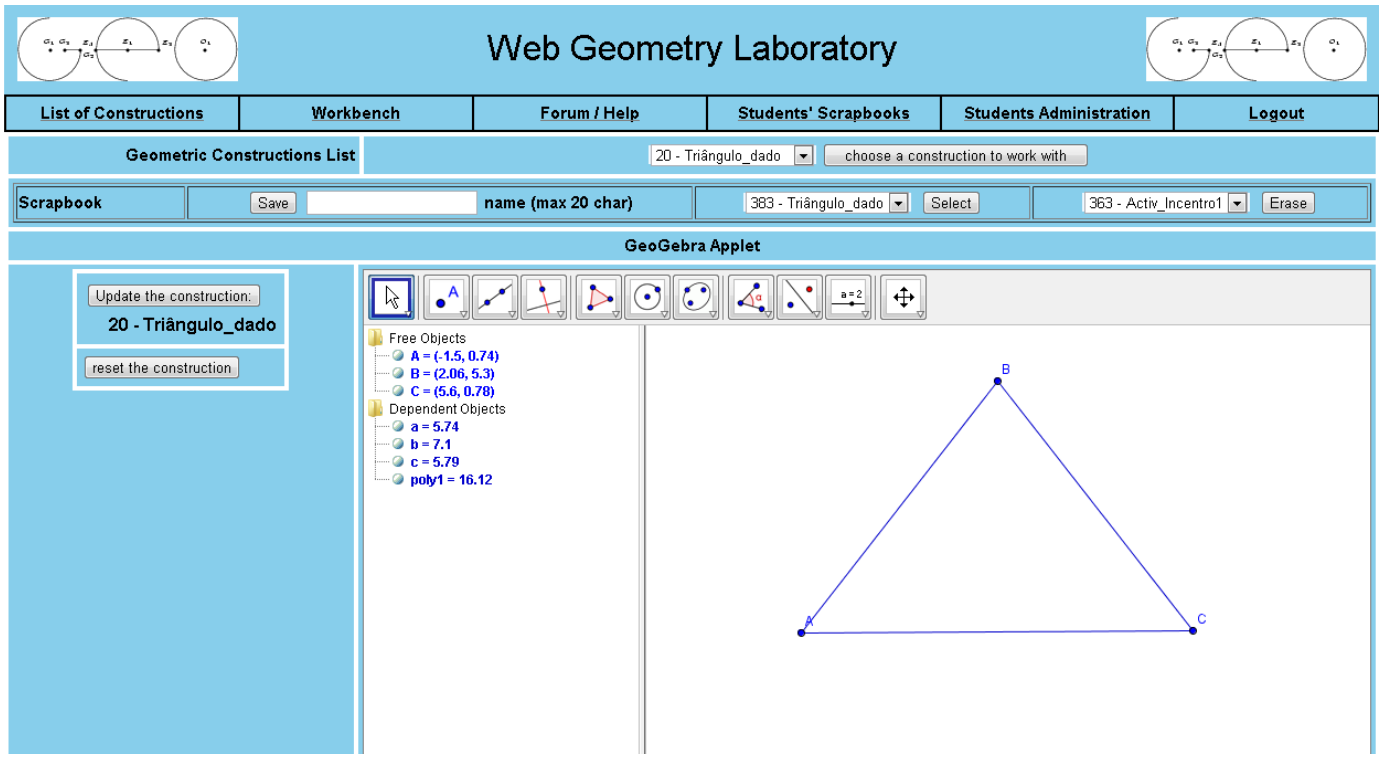

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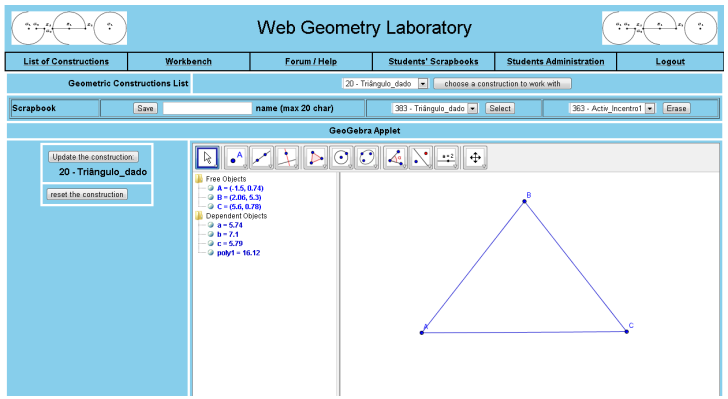

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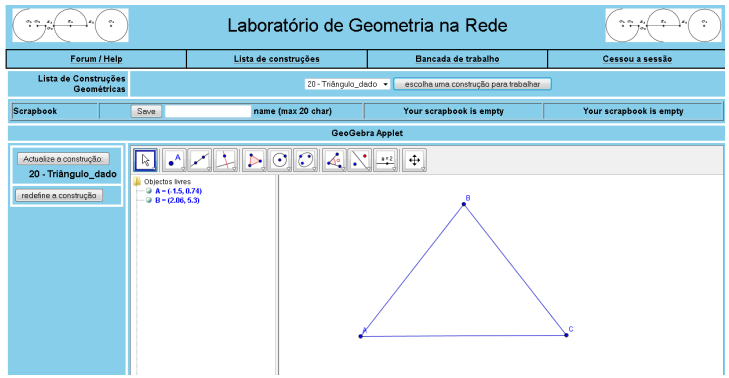

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WGL in Classroom

The teacher helps students with a aditional comment at initial construction:

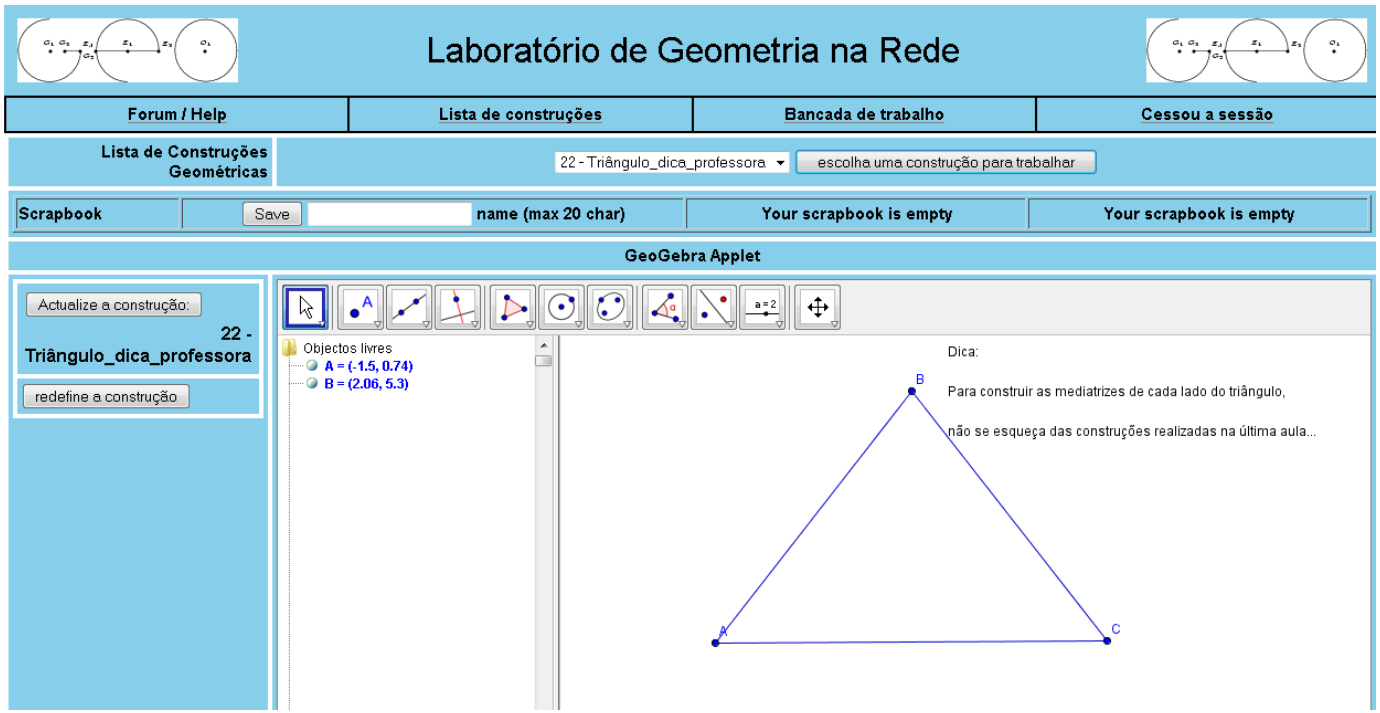

Figure: Triangle, teacher suggestion

WGL in Classroom

At this stage the teacher can access the constructions made by the students, as shown in the picture:

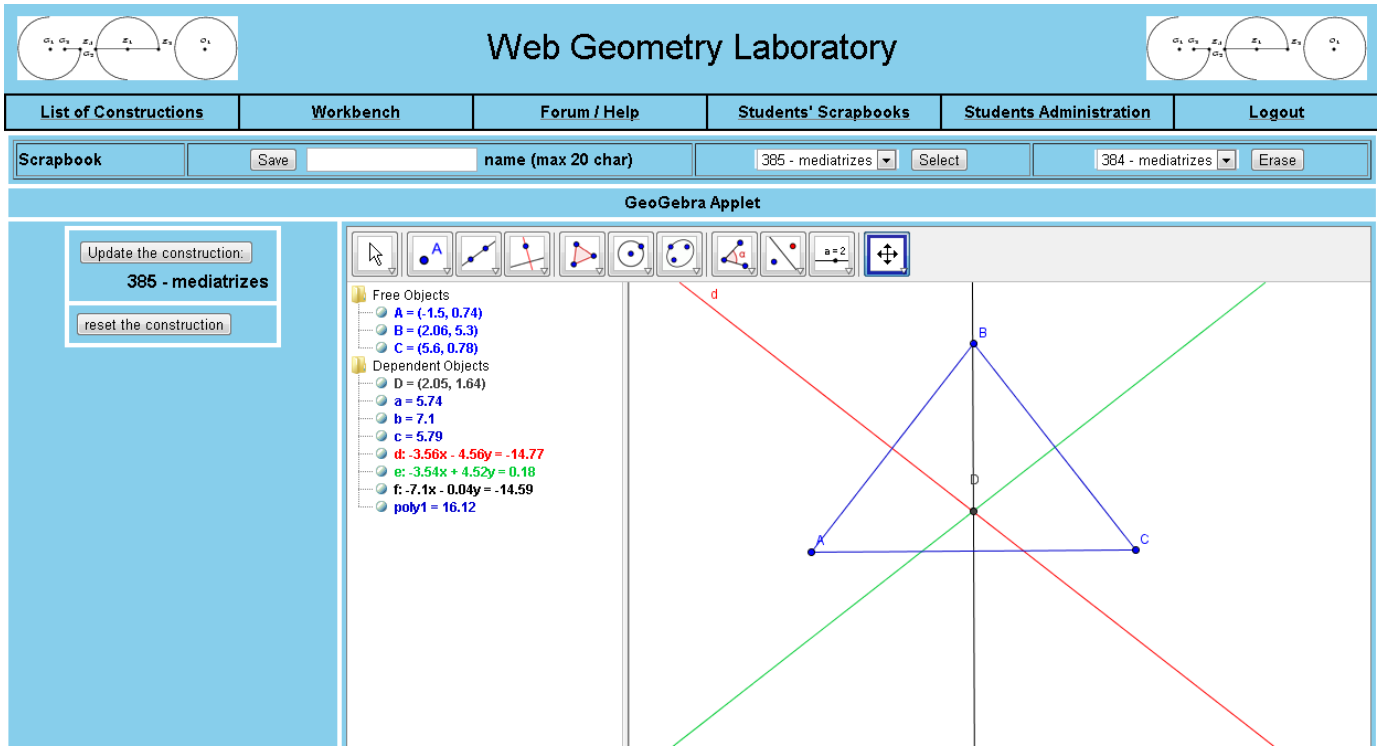

Figure: Teacher can access the constructions made by the students – during the class

WGL in Classroom

The students have finished their construction.

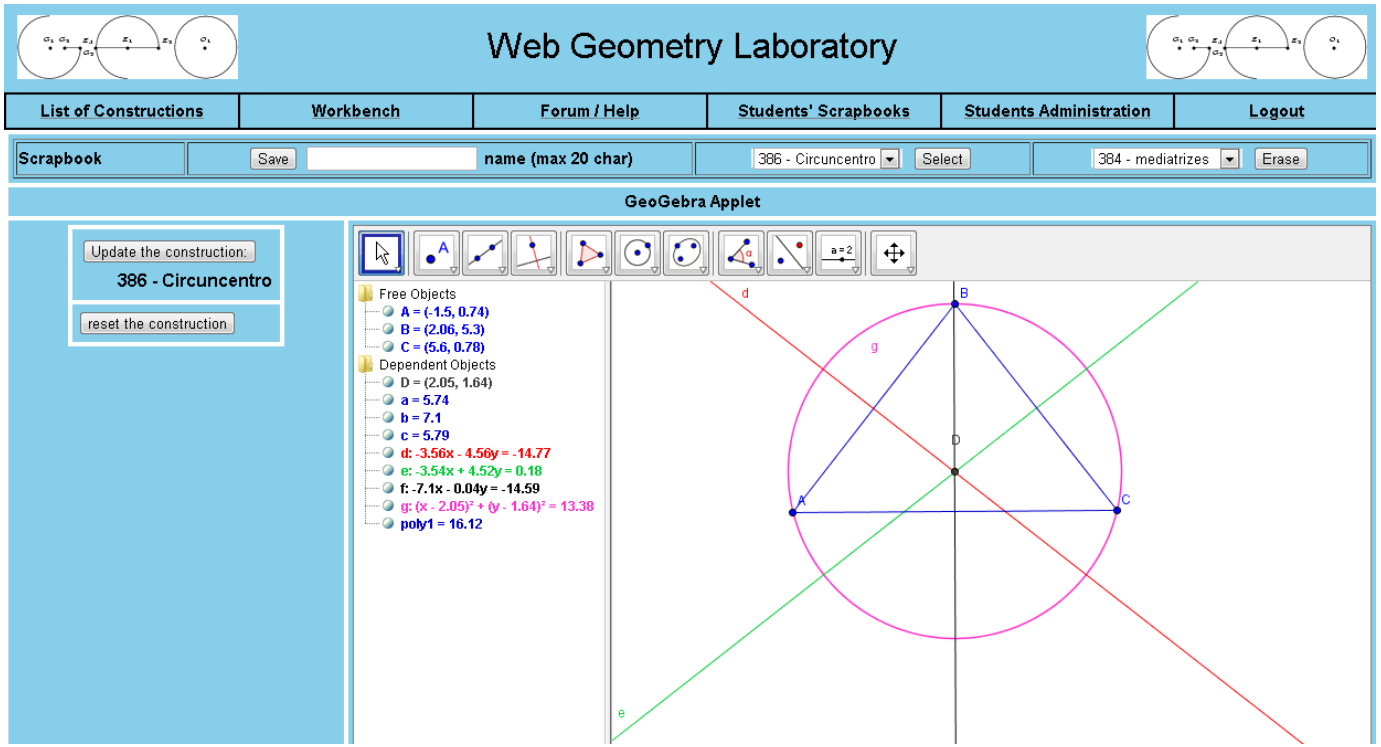

Figure: Teacher can access the constructions made by the students – end of class

Conclusion & Future Work

WGL is a work-in-progress software:
Tasks implemented:

- Integration of a DGS (GeoGebra)
- Use of a geometric repository (individual/collective).

Tasks to do (yet to be completed):

- Collaborative Module — groups; users; fusion of constructions;
- Adaptative Module — capture the users interaction (geometric);
- GATPs Integration — using a GATP to validate a construction and/or prove a given conjecture.

prototype accessible at:

`http://hilbert.mat.uc.pt/WebGeometryLab/`

Bibliography


Santos, V. and Quaresma, P. (2012).
Integrating DGSs and GATPs in an adaptative and collaborative blended-learning Web-environment.
In *First Workshop on CTP Components for Educational Software (THedu'11)*, volume 79 of *EPTCS*.


Wang, Q. (2010).
Using online shared workspaces to support group collaborative learning.
Computers & Education, 55(3):1270 – 1276.


Wei, C. S. and Ismail, Z. (2010).
Peer interactions in computer-supported collaborative learning using dynamic mathematics software.
Procedia - Social and Behavioral Sciences, 8(0):600 – 608.
International Conference on Mathematics Education Research 2010 (ICMER 2010).