

Adaptive Strategies in the Web Geometry Laboratory

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The Web Geometry Laboratory

The Web Geometry Laboratory (WGL) is a blended-learning Web-environment for geometry. The main features of the Web Geometry Laboratory (v1.4) are:

An integrated DGS (GeoGebra Javascript applet);

The screenshot displays the Web Geometry Laboratory (WGL) interface. At the top, the title "Web Geometry Laboratory" is centered, with "Teacher: Pedro Quarzema" on the right. Below the title is a navigation bar with tabs: "Förums / Help", "List of Constructions", "Werkkenn", "Administration", "Collaborative Work", and "Logout".

The main content area is divided into two sections. On the left is a "Geometric Constructions List" with a search bar and a "Scrapbook" section. The selected construction is "2131 - Teorema de Varignon". Below the list is a "test the construction" button. On the right is the "GeoGebra Applet" window, which shows a geometric construction of a quadrilateral with its midpoints connected to form an inner parallelogram. The vertices of the outer quadrilateral are labeled A, B, C, D, and the midpoints are labeled P, Q, R, S. A dashed line passes through the vertices of the inner parallelogram.

On the left side of the applet window, there is a list of parameters and their values:

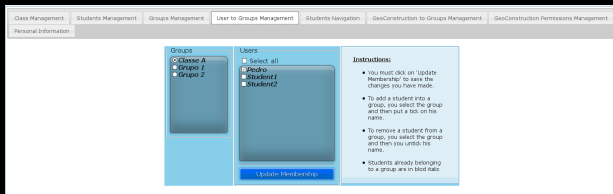
- A = (5.74, 0.9)
- B = (7.74, 0.9)
- C = (-1.02, 0.9)
- D = (2.58, -0.2)
- a = 7.38
- b = 3.62
- c = 5.27
- d = 3.77
- Q = (2.38, 2.38)
- R = (6.74, 2.35)
- S = (5.16, 0.31)
- P = (0.78, 0.34)
- e = 4.38
- f = 2.58
- g = 4.38

At the bottom of the applet window, it says "Production Server: v1.4.26".

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A user's management module for: administrator(s), teachers and students, allowing the definition of classes and groups;



The screenshot displays the 'User to Groups Management' interface. At the top, there is a navigation bar with tabs for 'Class Management', 'Students Management', 'Groups Management', 'User to Groups Management' (which is active), 'Students Navigation', 'GeoConstruction to Groups Management', and 'GeoConstruction Permissions Management'. Below the navigation bar is a 'Personal Information' section. The main content area is divided into three panels:

- Groups:** A list containing 'Class A', 'Grupo 1', and 'Grupo 2'. 'Class A' is selected with a radio button.
- Users:** A list containing 'Select all', 'Pedro', 'Student1', and 'Student2'. 'Pedro' is selected with a radio button. Below this list is a blue button labeled 'Update Membership'.
- Instructions:** A list of instructions:
 - You must click on 'Update Membership' to save the changes you have made.
 - To add a student into a group, you select the group and then put a tick on his name.
 - To remove a student from a group, you select the group and then you untick his name.
 - Students already belonging to a group are in bold italic.

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A repository of geometric problems: each user has his/her own list of constructions;

A permissions system allowing the sharing (or not) of each construction between users and groups;

The screenshot shows a web interface for a user named Pedro 14, displaying a list of 14 constructions. The interface includes a header with the user's name and a table with columns for Name, Description, Date of submission, See details, Update, and Delete. The table contains 14 rows of construction data.

Name	Description	Date of submission	See details	Update	Delete
TrianguloInscrito	Exemplo de triângulo inscrito.	2013-11-06	⌵	✓	✖
pappus		2013-12-17	⌵	✓	✖
User_107_CWS_169	User_107_CWS_169	2015-01-11	⌵	✓	✖
bissectriz		2015-01-23	⌵	✓	✖
User_107_CWS_184	User_107_CWS_184	2015-02-24	⌵	✓	✖
bestedesessao1		2015-05-09	⌵	✓	✖
User_107_CWS_195	User_107_CWS_195	2015-05-26	⌵	✓	✖
Recta Pappus		2015-05-26	⌵	✓	✖
cadgme2016		2016-08-02	⌵	✓	✖
cadgme2016a		2016-08-02	⌵	✓	✖
cadgme2016b		2016-08-02	⌵	✓	✖
cadgme2016c		2016-08-02	⌵	✓	✖
User_107_CWS_198	User_107_CWS_198	2016-08-12	⌵	✓	✖
User_107_CWS_199	User_107_CWS_199	2016-08-12	⌵	✓	✖

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The Web Geometry Laboratory (WGL) is a blended-learning Web-environment for geometry. The main features of the Web Geometry Laboratory (v1.4) are:

An collaborative module, where a given geometric task can be worked collaboratively by a group of users (exchanging textual (chat) and geometrical information);

The screenshot displays the Web Geometry Laboratory (WGL) interface. At the top, a green banner reads "Group Discussion: Construct the circumscribed circle of a triangle". Below this, the main workspace is divided into two panels: "Group" and "Individual". The "Group" panel shows a construction of a triangle with its circumcenter O and circumradius r . The "Individual" panel shows the same construction but with a message: "The group construction is locked by Pedro".

Both panels feature a toolbar with various geometric tools and a list of variables on the left side. The variables listed are:

- $A = 12.66$
- $B = 14.514$
- $C = 20.90536$
- $a = 6.48$
- $b = 4.752$
- $c = 5.89$
- $r = 8.06 - 5.69i - 12.36$
- $g = 8.02 + 0.9i + 17.58$
- $O = (2.44, 2.05)$

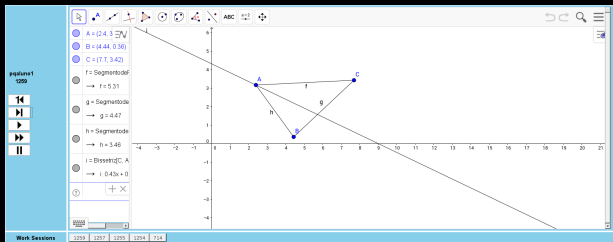
At the bottom, a chat window is visible with the following messages:

- Pedro: Release it as soon as finished or asked by a colleague
- Pedro: The construction is locked by Pedro
- Pedro Quaresma: no instável vai já para AJAX/JSON/Query
- Pedro Quaresma: não sei q functionar no instável
- Pedro Quaresma: está q functionar no instável... mas não adeste plicar

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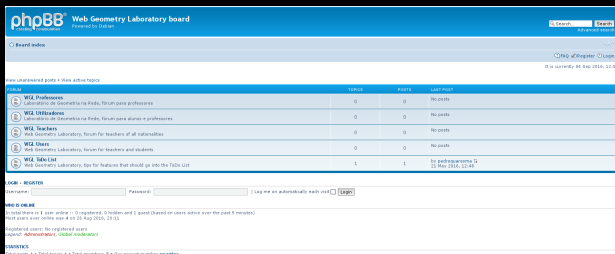
An adaptive module, allowing the capture of all the information regarding the students interactions with the system. This information can then be viewed and analysed by teachers;



The Web Geometry Laboratory

The Web Geometry Laboratory (WGL) is a blended-learning Web-environment for geometry. The main features of the Web Geometry Laboratory (v1.4) are:

A forum to allow the exchange of messages between users about different subjects regarding the *WGL*.



The screenshot shows the phpBB forum interface for the Web Geometry Laboratory board. The page title is "Web Geometry Laboratory board" with the subtitle "Powered by phpBB". The forum is currently displaying the "Board index" page. A navigation bar at the top right includes a search function and a user status indicator: "You are currently not logged in, 22 Sep 2016, 12:07".

Below the navigation bar, there is a section for "New unanswered posts • View active topics". This section contains a table with the following data:

Forum	TOPICS	POSTS	LAST POST
WGL - Professores Laboratório de Geometria na Prática, Fórum para professores	0	0	No posts
WGL - Utilizadores Laboratório de Geometria na Prática, Fórum para alunos e professores	0	0	No posts
WGL - Teachers Web Geometry Laboratory, forum for teachers of all nationalities	0	0	No posts
WGL - Users Web Geometry Laboratory, forum for teachers and students	0	0	No posts
WGL - Site List Web Geometry Laboratory, list for features that should go into the Site List	1	1	by pedroavareira G 22 Sep 2016, 12:07

Below the table, there is a login section with the following text: "LOG IN • REGISTER", "Username: [input field], Password: [input field], Log me in automatically each visit [input type="checkbox"], [Log In]".

Below the login section, there is a "WHO IS ONLINE" section with the following text: "In total there is 1 user online (0 registered, 0 hidden and 1 guest) (based on users active over the past 15 minutes) that were ever online since 4 on 20 Aug 2016, 20:12".

Below the "WHO IS ONLINE" section, there is a "REGISTERED USERS" section with the following text: "Registered users: No registered users (except: [Administrators](#), [Global moderators](#))".

Below the "REGISTERED USERS" section, there is a "STATISTICS" section with the following text: "2016 users in a total topics in a total members in a forum record member speakers".

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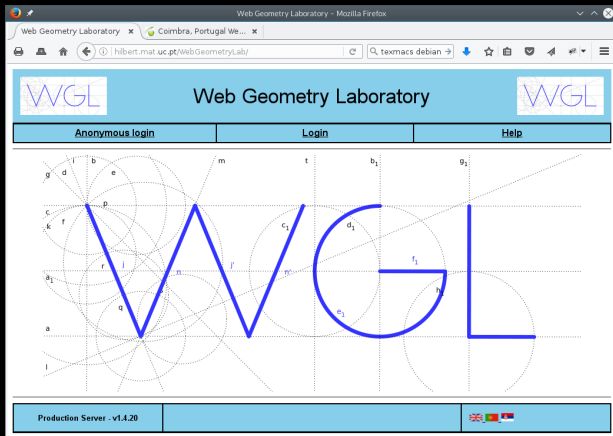
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A forum to allow the exchange of messages between users about different subjects regarding the *WGL*.

The Web Geometry Laboratory is an open-source project
(<http://webgeometrylab.sourceforge.net/>)

The Web Geometry Laboratory

Server at: hilbert.mat.uc.pt/WebGeometryLab



Translation to Portuguese and Serbian (...seeking volunteers for other languages)

Adaptive Strategies in *WGL*— Students

To be able to build individual students profiles and/or individual learning paths, the system collects geometric information about the students' interactions when in the regular, stand-alone, mode.

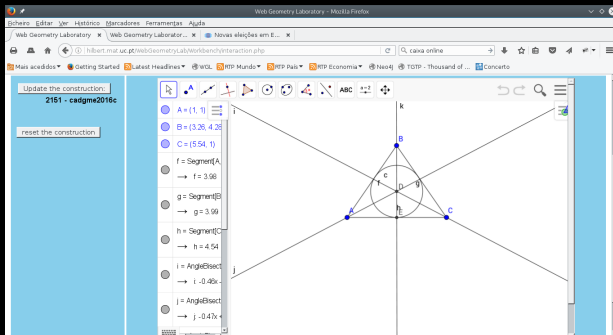
The screenshot displays the Web Geometry Laboratory (WGL) interface. The browser window title is "Web Geometry Laboratory - Múcia Freitas". The address bar shows the URL: `http://bert.mat.uc.pt/webGeometryLab/new/ibench/interaction.php`. The interface includes a menu bar with options like "Arquivo", "Editar", "Ver", "Histórico", "Marcadores", "Ferramentas", and "Ajuda". The main workspace shows a geometric construction of a triangle with vertices A , B , and C . The centroid is marked as D . Medians are labeled f , g , and h . The construction is defined by the following objects and their equations:

- $A = (1, 1)$
- $B = (3.26, 4.26)$
- $C = (5.54, 1)$
- $f = \text{Segment}[A, D] \rightarrow f = 3.98$
- $g = \text{Segment}[B, D] \rightarrow g = 3.99$
- $h = \text{Segment}[C, D] \rightarrow h = 4.54$
- $i = \text{AngleBisect} \rightarrow i = -0.46x$
- $j = \text{AngleBisect} \rightarrow j = -0.47x$

The interface also features a toolbar with various geometric tools and a sidebar with buttons for "Update the construction" and "reset the construction". The sidebar also displays the construction ID "2151 - cadgme2016c".

Adaptive Strategies in *WGL*— Students

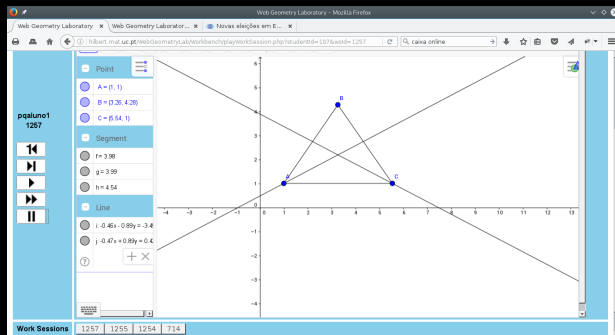
To be able to build individual students profiles and/or individual learning paths, the system collects geometric information about the students' interactions when in the regular, stand-alone, mode.



... Big brother is watching you.

Adaptive Strategies in *WGL*— Teachers

The teacher is able to see the work done, from the first step to the last step: step by step, in motion, normal or faster speed, to pause and to resume.



Analysing the steps done by the student to solve the task, the teacher can assert the student's van Hiele levels of geometric knowledge.

Case studies in Portugal and Serbia

The development work currently being done regards the construction of a learning path editor

This editor will allow the teacher to build learning paths differentiated by students' profiles

Each learning paths will be a (non-)linear sequence of tasks to be solved by each student

The *WGL* platform will include in future stages of development a geometric automated theorem prover to be used in the automatic, or semi-automatic construction of the students profiles, and in the learning process

Thank You



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<http://www.uc.pt/en/congressos/cadgme2018>