Title	Wikiglass: a learning analytic tool for visualizing collaborative wikis of secondary school students
Author(s)	Hu, X; Ip, J; Sadaful, K; Lui, G; Chu, SKW
Citation	The 6th International Conference on Learning Analytics and Knowledge (LAK 2016), Edinburgh, UK., 25-29 April 2016. In Conference Proceedings, 2016, p. 550-551
Issued Date	2016
URL	http://hdl.handle.net/10722/232175
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Wikiglass: A Learning Analytic Tool for Visualizing Collaborative Wikis of Secondary School Students

Xiao Hu[1] Jason Ip[2] Koossulraj Sadaful[3] George Lui[3] Sam Chu[1]
[1.] Faculty of Education [2]Faculty of Business and Economics [3]Department of Computer Science
The University of Hong Kong
Pokfulam Road, Hong Kong
{xiaoxhu, jasonipcy, ksadaful, luifei23, samchu}@hku.hk

ABSTRACT
This demo presents Wikiglass, a learning analytic tool for visualizing the statistics and timelines of collaborative Wikis built by secondary school students during their group project in inquiry-based learning. The tool adopts a modular structure for the flexibility of reuse with different data sources. The client side is built with the Model-View-Controller framework and the AngularJS library whereas the server side manages the database and data sources. The tool is currently used by secondary teachers in Hong Kong and is undergoing evaluation and improvement.

CCS Concepts
• **Human-centered computing→Visual analytics** • *Human-centered computing~Wikis* • **Applied computing → Collaborative learning**

Keywords
Wiki; visualization; statistics; timeline; collaborative writing

1. INTRODUCTION
Wiki is widely regarded as a useful tool to facilitate project-based learning [1], but the amount of learning evidence made available by the tool may discourage teachers from adopting it because of the perceived increase of workload in continuous student assessment [2]. To tackle this problem, tools have been built to assist teachers in processing and making sense of the large amount of continuous student input [3]. However, few existing tools work with student writings in Chinese and are designed for secondary school teachers who often have heavy workload and may not be expert computer users. In this study, we build a learning analytic tool, Wikiglass, to help secondary school teachers in Hong Kong and surrounding regions to monitor student collaboration and progress in group projects using Wikis.

For this initial round of development, teachers use PBworks as the platform for their students to collaborate on inquiry-based projects over a five-month period. The students are required to work in groups each consisting of about five students. Each group write their project report on their Wiki, with different sections of the report (e.g., Introduction, Methodology, etc.) written on separate pages. It is expected that the clear, accurate and timely information provided by Wikiglass can help teachers keep track of student progress, based on which they can provide proper interventions to needed individual and/or groups of students *during* the learning process instead of *after*.

LAK '16, April 25-29, 2016, Edinburgh, United Kingdom
ACM 978-1-4503-4190-5/16/04.
DOI: http://dx.doi.org/10.1145/2883851.2883966

2. SYSTEM ARCHITECTURE
Figure 1 shows the general structure of Wikiglass which can be divided into two layers, client and server, and four main components: visualization, logic, Wikiglass Application Program Interface (API) and the database.

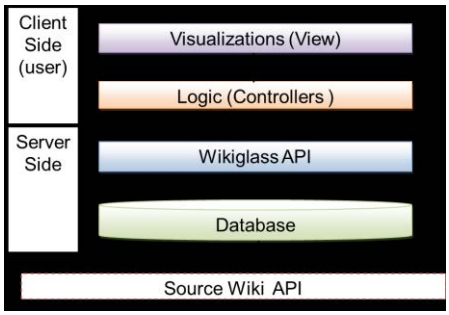

Figure 1: System architecture of Wikiglass.

2.1 The Client Side
The client side is implemented with the AngularJS library [4] and the Model-View-Controller (MVC) framework, which allows for flexibility in reuse and ease of development. This architecture also enables distributing computation load between the server and the client so that the server can be more efficient and robust.

The client side framework consists of two layers, the Controller and the View (with the Model in the MVC framework being the data from the server). The View is the visualizations the users will see, such as graphs, tables and charts. It does not concern itself with the requests for or the actual processing of the data. The latter functions are accomplished within the Controller. The Controller is responsible to direct user's requests, request data from the API, process the data and render it using the View.

2.2 The Server Side
The server side is responsible for data collection and preprocessing. Raw data from source Wikis (e.g., PBworks) are obtained through the APIs provided by the source, including but not limited to student user information, page content, and revision records. Data preprocessing involves stripping unneeded tags and extracting useful elements. A database is set up to store the processed raw data as well as derived statistics (e.g., number of revisions made by each student) for different purposes of analysis and visualizations.

To maximize the flexibility of Wikiglass, we designed a generic and easily readable API for Wikiglass. It makes the data in the Wikiglass database accessible quickly by different client applications. The endpoints transfer data are in the JavaScript Object Notation (JSON) format which nowadays is a universal format for data exchange on the Internet. The API makes it convenient to develop alternative client sides.

3. FEATURES

3.1 Visualization

Currently Wikiglass provides two visualization modes. The statistics mode allows teachers to compare statistics of groups in one class or individual students in one group (Figure 2). The statistics include revision counts, total words in the latest versions of Wiki pages, page counts, and number of words added and deleted by each student. For each student, Wikiglass also shows the number of words added and deleted across different pages.

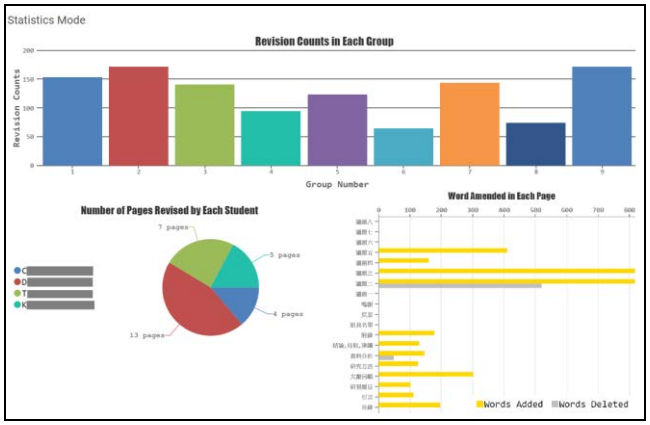

Figure 2: Statistics mode of visualization.

The timeline mode displays statistics accumulated by dates on a weekly basis (Figure 3). It also includes total revision counts for each group and each student in a group as well as number of word amendment made by each group. The timeline visualizations allow teachers to monitor the progress of the groups or individual students in a clear and easy manner.

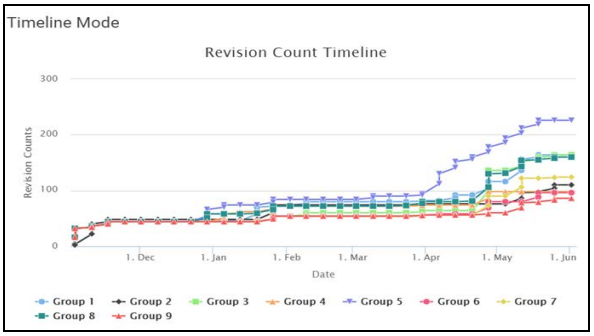

Figure 3: Timeline mode of visualization.

Nearly all visualizations are clickable, facilitating teachers' navigation in the system. For example, clicking one bar (corresponding to one group) in the class page shown in Figure 2 will lead the user to the page of that group where contributions of group members are displayed. Clicking one pie (corresponding to one student) in the pie chart shown in Figure 2 will lead the user to the page of that student where his/her contributions to different pages are visualized. Similarly, the lines in the timeline visualization are all clickable and clicking each line leads to the corresponding page of the corresponding group or student.

3.2 Daily update of database

As the student projects last five months, teachers need to monitor student progress on a continuous basis. Therefore, Wikiglass needs to update its database regularly. To fulfil this purpose, a task scheduler in the server side is set up to retrieve all the updated versions of the Wikis in the source side and update the databases accordingly. The task scheduler is currently set to update on a daily basis as it is the estimated usage frequency of the teachers. Once the new data are extracted and processed, the visualizations will be automatically updated on the client side. The task scheduler is designed to be reconfigurable to different time slots and/or different frequency.

3.3 Event Logging

For usage statistics, users' interactive activities with Wikiglass are logged, such as duration of use, number of views of each page, and the type of visualization mode (statistics/timeline) being used. This information will be useful for subsequent analytics aiming to improve user experience and system functionality.

3.4 Weekly Summary

At the end of every week, teachers will receive emails summarizing the progress of the groups and students they teach. In this way, teachers can have a quick review on the performance of different groups and students, and be reminded to logon Wikiglass for more detailed information.

4. FUTURE WORK

The next steps include identifying and visualizing quality indicators of student collaborative writing and evaluating the impacts of the tool on teaching and learning.

5. ACKNOWLEDGMENTS

The work was partially supported by an Early Career Scheme grant from the Research Grants Council of the Hong Kong Special Administrative Region, China. (Project No. HKU 27401114) and a Teaching Development Fund by the Faculty of Education, University of Hong Kong.

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