Analysing Microblogs of Middle and High School Students

Javiera Born[1], Eliana Scheihing[2,⋆], Julio Guerra[3], and Luis Cárcamo[4]

[1] Universidad de Chile, Santiago, Chile
jborn@dcc.uchile.cl
[2] Universidad Austral de Chile, Valdivia, Chile
escheihi@inf.uach.cl
[3] Universidad Austral de Chile & University of Pittsburgh, Pittsburgh, USA
jguerra@inf.uach.cl
[4] Universidad Austral de Chile, Valdivia, Chile
luis.carcamo@gmail.com

Abstract. The Kelluwen project implements middle and high-school educational activities where the use of Web 2.0 tools is incorporated to improve collaboration construction, sharing and publishing of the learning outcomes. The Worklog tool, a microblogging space within the Kelluwen platform has an active role in the educational activities. Using probabilistic topic models, correlation analysis and principal component analysis (PCA), we analyzed micropost of 85 class groups participating in the Kelluwen project and found interesting relations of the types of messages posted and other factors such as the teacher participation in the microblog, the rural or urban nature of the schools and other aspects of the educational experience.

1 Introduction

A number of public educational policies and efforts have been carried out in Chile to incorporate technologies in the public educational system [9,2]. In the decade of the 90', the educational policies implemented the project Enlaces (www.enlaces.cl) which successfully deploy computer laboratories to nearly 100% of all primary and secondary schools in the country. Nowadays, this infrastructure is maintained and used in different levels, and in many cases, with a considerable amount of difficulties. In many cases, the school administrators set low importance to computer maintenance, networking and Internet connection, and reduce costs on the maintenance of this infrastructure. In other cases, due to disciplinary and educational concerns, some schools block the access to on-line systems like Facebook or Youtube, because they are considered as distracting resources. In summary, administrative difficulties, and cultural and technological gaps on teachers and administrative staff join together to make the incorporation of educational innovation using Web 2.0 in the school a very difficult endeavor

⋆ Financial support from Fondef- CONICYT under D08i-1074 project and DID-UACh.

C. Rensing et al. (Eds.): EC-TEL 2014, LNCS 8719, pp. 15–28, 2014.

[4]. In the other hand, the use of the Internet has grown very fast in Chile. Consumption studies have identify that 91% of the young population and 56% of the adults and elder adults are connected to the Internet. Thus, the use of social networking on-line tools and social media has reached the 89% of the population ref:iab2013.

The project Kelluwen [14] is an attempt to incorporate the effective use of social web tools (the Web 2.0) in formal curriculum of public education in southern Chile. The project target the socio-communicative skills in high school students and put forward activities combining traditional classroom activities and the use of social web tools as didactic resources. To better support such activities, the Kelluwen Web platform includes a microblogging tool called the Worklog (Bitácora in spanish) [12]. The Worklog tool was originally added as a complementary and informal channel for students and teachers to share information within and between different classrooms participating in the project while performing similar activities. During activities, students and teachers used the worklog to give opinion on the students' team works, share information, reflect about the ongoing activities, or simply say "hello". We claimed that the worklog is a valuable tool since it's logs of messages can be further reviewed to partially reconstruct or have a better idea of what "was going on" during the activities. Since the worklog was explicitly intended as an informal channel, one of the challenges of analysing the microblogging activity is to deal with the heavy use of slang and miswritten words.

In this work we use statistical based topic models to explore the microblogging messages of 85 classroom groups that used the worklog tool during 2011 and 2012, relating such activity with other parameters such as the participation of teachers, the level of completeness of the activities, and the urban/rural nature of the schools. We are interested to see to which extent the participation of the teachers in the worklog influences students' posts and to which extent the activity on the worklog reflect the success of the learning experiences.

The paper is organized as follows. The next section briefly reviews previous work done in two areas: text analysis on microblogging data, and the use of microblogs in educational settings. Section 3 describes the educational setting carried out in Kelluwen interventions, the microblogging platform -the Worklog- that support the activities, and the data set collected. Section 4 presents the pre-processing of the data set, the variables included in the analysis and the results of the topic model. Section 5 describes the results of the analysis of the use of the microblogging space and the factors that quantitatively and qualitatively describe the learning experiences. Section 6 presents the conclusions and discussion.

2 Related Work

2.1 Microblogging in Education

Regarding the use of Microblogging In Education (MIE), Gao et al [7] made a survey analysis of 21 research works published during the period of 2008 and

2011. They reported a wide variety of educational settings using microblogging, mainly as a informal communication platform supporting the learning activities. According to the authors, the analyzed works consistently concluded that microblogging effectively increases communication (both between students and between students and teachers), increase social presence, and help in building a learning community. However, published work is usually descriptive and lacks of deep analysis on the impact of using microbogging in the class. According to Ebner et al [6], the use of microblogging has two main advantages: it makes possible to post immediate feedback (especially in peer review and collaborative learning activities) and it allows to track the learning process. In their case study, students of a master degree program of Business in Austria used a microblog based on the open source software Indenti.ca. Other works report the impacts of using microblogging in reflective thinking [16,5]: as students are limited to 140 characters to express ideas, they are forced to express themselves in a concise and clear manner. Holotescu and Grosseck [10] showed how an entire course can be managed and delivered using a microblogging platform. They use Cirip.ro, a platform that enhance microblogging with group management, embbeded images and video, among other features.

2.2 Analysis of Microblogging Data

There is a considerable amount of research analyzing twitter (and other microblogging systems) activity in different context. In general, microblogging analysis is performed with a wide range of methods involving machine learning and natural language processing techniques. Abel *et al* [1] performed hashtags, entity, and topic extraction techniques using OpenCalais (www.opencalais.com) to build user profiles from twitter data. Paul and Drezde [13] presents the Ailment Topic Aspect Model (ATAM) where words describing ailments and diseases are taken from articles and used as prior knowledge to enhance a probabilistic topic modeling process done over twitter data covering public health trends. Yang *et al* [17] put forward a framework to perform dynamic pattern analysis on Twitter feeds. Their algorithm, SPUR (Summarization via Pattern Utility Ranking) analyzes topic patterns as the tweet feed goes on. Topics are extracted as a result of matrix factorization techniques, and divergence metrics are computed between topics in different times to build an evolution trace distinguishing topics that change, new topics appearance, topic disappearance, topic merging, etc.

3 The Kelluwen Activities and Platform

The Kelluwen project developed a series of *Didactic Designs* to be used in middle and high school levels in 2 classes: Language and History. A *Didactic Design* (DD) covers a unit of content as specified in the chilean public school curriculum, and contains a series of activities which blend traditional classroom learning strategies with the use of social web tools like Wordpress, Youtube, Panoramio, etc. In this way, Kelluwen aims to bring the sharing and communication capabilities of the social web, to formal learning activities in schools. A common DD

sequences around 9 activities, and each activity is intended to last 1 class period (1 and a half hours). In the DD, the students work in teams with the goal of creating an outcome that is finally published in a social Web tool and reviewed by peers. To make this happen, activities are organized into three stages: a *motivation stage*, where students are introduced to concepts and topics, and they must study the topic and begin to incorporate the knowledge; a *creation stage*, where using the learned concepts they must generate new content, such as a blog or a video, exercising their communicative skills; and an *evaluation stage*, where the generated content is now passed to other students, which may be from the same classroom or from a different classroom working in the same DD, who must evaluate and give feedback on the work done. They also have the opportunity to do an auto-evaluation and receive comments from the guiding teacher.

During the activities, students and teachers have access to the Kelluwen Platform, a Web system designed to support the learning activities by providing access to material and tools to facilitate the communication and monitoring of the work. Although the main interaction between students and teachers happens in person, the Kelluwen Platform and its tools are used to a considerable extent. As mentioned before, the platform include a tool called the Worklog that provides each class with a microblogging space. Within the 3 years of the Kelluwen project interventions, the use of the Worklog tool varied as the project developed and other tools for communication and work management were added to the platform. Until the first semester of 2011, the microblog was mainly used to share links to the teams work outcomes and was the only communication tool between different classrooms. Up to that moment, the use of the Worklog was generally mandatory in most of the classrooms. After a new tool for work publishing and peer review [15] was deployed to the Kelluwen platform in the second semester of 2011, the worklog tool started to be used as a complementary non-mandatory tool. Even when optional, students tend to largely use it for greetings, sharing information, commenting and giving opinions. Additionally, and since it is an informal communication space, the Worklog is full of slang, emoticons (expressions of emotions through ASCII characters) and miswritten words, which make challenging to perform any text analysis of the posts.

3.1 The Dataset

We collected microblogging posts of 85 class groups working on 24 different Didactic Designs (DD) during the second semester of 2011 and the first semester of 2012 as during these periods the Worklog use was optional (we believe that the analysis of posts when the tool was of non-mandatory use is more relevant). Each DD is designed for one of two areas: Language or History. There were 46 class groups working on DDs in the area of Language, and 39 in the area of History. Interventions covered middle and high school: there were 48 class groups from levels 6-8, and 37 class groups from levels 9-12 (in the chilean educational system, the grades 9-12 correspond to high school). Participating schools are from different cities and towns covering great part of the southern area in Chile. Some cities are relatively large urban zones and some cities are middle or small

size cities dominated by rural characteristics. We labeled all school as urban or rural depending on the size of the city. There are 64 class groups from schools located in urban areas, and 21 class groups from rural areas. About the messages in the worklog, there are a total of 9010 posts, where 8432 were posted by 1849 students (there were 2540 registered students organized in 576 teams) and 510 were posted by teachers. Histograms of the students and teachers posts by class group are showed in Figure 1, top and bottom charts, respectively. It is surprising that many students posted since, as a blended learning activity, the access to a computer and Internet connection during classes was in many cases restricted to one computer per group.

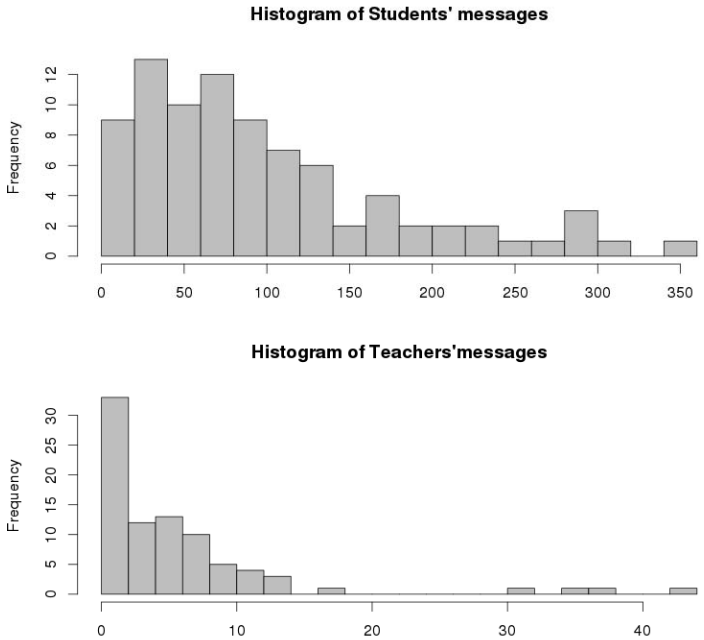

Fig. 1. Histograms for the number of messages (posts) from students (top) and teachers (bottom). The x-axis represents the number of posts. Students' posts distribution has a median of 74.0, mean of 99.2, and 50% of data between 38 and 127, and a maximum of 343 messages in one of the class groups. Teachers' distribution has a median of 4, mean of 6, and a maximum of 43 messages in one of the class groups.

4 Analysis of the Microblogging Posts

4.1 Preparing the Data

A first general observation of the posts shows that most repeated words were a) emoticons, that is, expressions of emotions through ASCII characters,

b) links to videos, images and articles on the web, and c) connectors of sentences, both well written and mis-written. For a more significant result, these 3 aspects were partially removed from the messages. Both a) and c) presents a set of words which should be removed, along with numbers and punctuation. Words with 1 character or more than 20 were removed as well, as they don't provide information. For b), all links containing *http://* were substituted by only *http*, with the exception of Youtube videos which were substituted by the *youtube* string (some didactic designs ask for publishing videos in Youtube, although a special tool is available in the platform to put the links to the work done). We use R and the package *tm*[1] to perform these data filtering.

4.2 Topic Extraction

We are interested on extracting semantic features from the text of the messages and further contrast these semantic features with other parameters of the activity of the class groups like the level of participation of the teachers. After considering various options for the analysis of the microblogging messages, we leaned towards the Probabilistic Topic Models strategy using Latent Dirichlet allocation (LDA) [3]. LDA is widely used in text analysis to uncover latent topics within collections of text documents. The general assumption in LDA is that each document (in our case a document is a microblogging post) is generated from a latent set of topics, and each topic is a probability distribution among the entire vocabulary of the collection. LDA analyses co-occurrence of words in the documents to generate the set of topics (the number of topics should be defined in advance) by following two optimization goals: minimize the number of probable topics related to each document (describe each document as concisely as possible), and minimize the number of highly probable words within each topic (make topics as specific as possible). Observe that these two optimization goals are in conflict due to the multi-topic nature of the documents. Working with LDA has two main advantages. The first advantage is that the model can deal with multi-topic documents. In our case, a preliminary observation showed that roughly, microblogging posts are a combination of greeting (say hello in different ways), opinions (mostly when a team opines about the work of others), and specific information (providing a link or talking about the content related to the DD). The second advantage is that by grouping words that occurs together, LDA is able to deal with synonyms (different words with the same meaning) and polysemy (a word having different meaning depending on the context), which is of great use in our case where we have a considerable amount of mis-written words.

As mentioned before, a preliminary observation roughly showed 3 topics: opinion, greeting, information. Considering this, we run the topic modeling for 3, 4 and 5 topics using *R* and the package *lda*[2] with 50000 iterations. We repeat each experiment 3 times and compute log-likelihood. Results of maximum

[1] `http://cran.r-project.org/web/packages/tm/vignettes/tm.pdf`
[2] `http://cran.r-project.org/web/packages/lda/lda.pdf`

log-likelihood run for the experiment with 3 topics are shown in the table 1 where the top 10 probable words within each topic are shown.

A review of the probabilities within each topic reveals that the top 10 words cover 12.12%, 14.42% and 10.81% percent of the topic, respectively. Note in the table that topic 1 and topic 2 are clearly about opinion and greeting, respectively. Topic 3 is informational and contains words related to the content of the DDs. When repeating the process for 4 and 5 topics, the first two topics (opinion and greeting) remain, and the rest of the topics split the words accordingly to the different content in different DDs. Because we aim to analyze the topics regardless of specific content of the didactic designs, we decided to consider only three topics in further analysis, where the third topic includes information messages from the different themes. We further refer to the topics by their general description: "opinion", "information" and "greeting". As we will see in section 5, we used those 3 topics and the topic-micropost probabilities to aggregate those probabilities to the level of the class group. In this form, we computed an *opinion* score, and *information* score and a *greeting* score for each of the 85 class groups.

Table 1. Original words and an approximate translation, where the three topics can be observed

Topic 1	**Topic 2**	**Topic 3**
trabajo *(work)*	hola *(hello)*	mundo *(world)*
bueno *(good)*	ola *(hello)*	literario *(literary)*
gusto *(like)*	wena *(cool)*	texto *(text)*
actividad *(activity)*	cabros *(pals)*	textos *(text)*
trabajos *(works)*	oli *(hi)*	literarios *(literary)*
bien *(nice)*	gusta *(like)*	onirico *(oniric)*
parecio *(thought)*	saludos *(greetings)*	http
kelluwen	chicos *(boys)*	hechos *(facts)*
entretenido *(fun)*	gay	cotidiano *(daily)*
buena *(cool)*	holaa *(hello)*	vida *(life)*

4.3 Indicators

The analysis performed in the next section contrast the topics extracted from the messages within a class group posts with various factors considered as indicators of the success of the activities. These factors are described below.

- **Participation of teachers:** we consider the fact that teachers participated in the microblog can influence the type of comments posted by students, especially pushing students towards opinion and informational messages. This indicator is computed as the percentage of teacher messages over all messages posted in each class group and is named *teacher participation*.
- **Progress of the experience:** some class groups never finished the activities of the DD. This is a clear result of whether the teacher decided to use the platform or not, and if they did not, some influence related to the stage where the activity was abandoned might be visible in the microblog. This indicator is computed as the percentage of completed activities in each class group and is called *progress*.

- **Regularity of the activities:** related to the previous one, we would like to know if the regular use of the platform influence the messages. This is measured through obtaining the differences in days between activities, and determining the mean and variance for each class group, so that a small mean and variance implies regularity. The two factors are called *mean* and *variance*.
- **Number of Students:** we include in the analysis the number of students that belong to each class group, that is not necessarily the same number of students who participate in posting in the microblog. This factor is named *students*.
- **Location:** the schools are characterized as urban or rural depending on the size and importance of the city in which the school is located. Regional capitals are characterized by urban dynamic, and in contrast non-capital cities and towns have a strong dominance of rural aspects. This factor is named *location*.
- **Didactic Design:** although not a measured variable, we consider the Didactic Design as a factor in further analysis because it could explain the nature of the use of the microblogging tool. This factor is called *design*.

5 How the Micropost Topics Relate to the Class Indicators?

Using the 3 topic model obtained in the previous section, we aggregate the topic probabilities distributions of the posts belonging to the each class group. We compute class-level topic distributions by this aggregation approach since it has been pointed out that in the use of LDA to generate aggregated topic distributions, a good strategy is to input the documents as an unstructured collection and then perform a hierarchical aggregation of the topic distributions to the upper level [8]. In the following analysis we first compute correlations among the topic scores (*greeting*, *opinion* and *information* scores) and the other 7 indicators previously described. Then we perform Principal Component Analysis (PCA) to show the relation of the factors in a 2 dimensional visualization.

Table 2. Correlation matrix for 10 components

	I	O	G	T	P	S	M	V	L	D
Information		0.42	**-0.69**	0.36	0.17	-0.10	0.07	0.03	-0.13	0.14
Opinion	0.42		-0.36	-0.04	0.07	0.04	-0.09	-0.02	0.14	-0.26
Greeting	**-0.69**	-0.36		-0.34	-0.23	0.07	0.00	-0.02	0.02	0.07
Teacher Part	0.36	-0.04	-0.34		-0.23	-0.10	0.48	0.17	0.19	0.26
Progress	0.17	0.07	-0.23	-0.23		0.21	-0.37	0.04	0.01	-0.15
Students	-0.10	0.04	0.07	-0.10	0.21		-0.14	-0.11	0.02	-0.10
Mean	0.07	-0.09	0.00	0.48	-0.37	-0.14		**0.66**	0.05	0.29
Variance	0.03	-0.02	-0.02	0.17	0.04	-0.11	**0.66**		0.17	0.14
Location	-0.13	0.14	0.02	0.19	0.01	0.02	0.05	0.17		-0.03
Design	0.14	-0.26	0.07	0.26	-0.15	-0.10	0.29	0.14	-0.03	

5.1 Correlation Matrix

Our first approach to the results is to observe the correlation matrix, which can be observed in Figure 2. It can be noted that correlation score (x) appear as significant in only two relations ($|x| \geq 0.5$): Between *Greeting* and *Information* scores, and between *Mean* and *Variance* of the regularity of the activities. The second relation is no surprise: there are few values on which these variables are calculated, and therefore, few outliers produce high variance. A *big* mean implies a big 'jump' in the times in the activities, and therefore, a very different value than the other small 'jumps', generating a high variance.

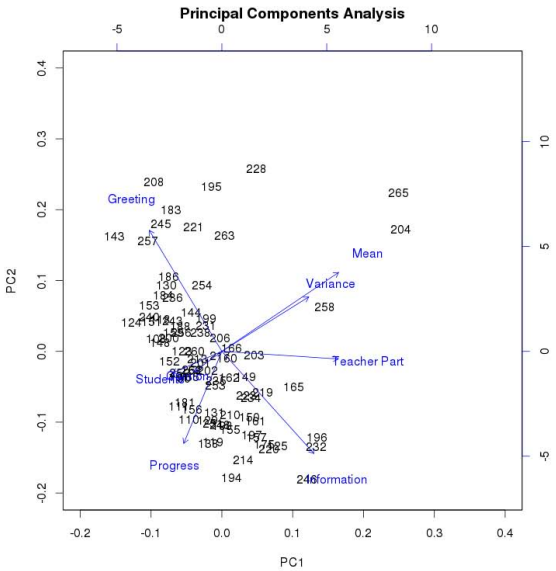

Fig. 2. Analysis over the 3 topic model probabilities and the indicators described. The main plane represents 40.08% of the data variance.

5.2 Principal Components Analysis

For a graphical analysis, we generate a Principal Component Analysis (PCA) over the data. The Figure 2, shows a two dimensional representation where correlations can be clearly observed as the arrow point to the same (positive correlations) or opposite (negative correlations) directions. The first correlation observed is the correlation between the *Mean* and *Variance*, previously described, and between *Greeting* and *Information* scores. A more interesting correlation is also observed in this chart: *Teacher Participation* seems to influence the probability of the messages of being labeled as *Information*. *Opinion* score, on the other hand, is inversely correlated to the *Mean* and the *Variance*, implying that a regular development of the experience influences the tendency to post *Opinion* messages. It can be noted that, in the top words of *Information* topic, the word

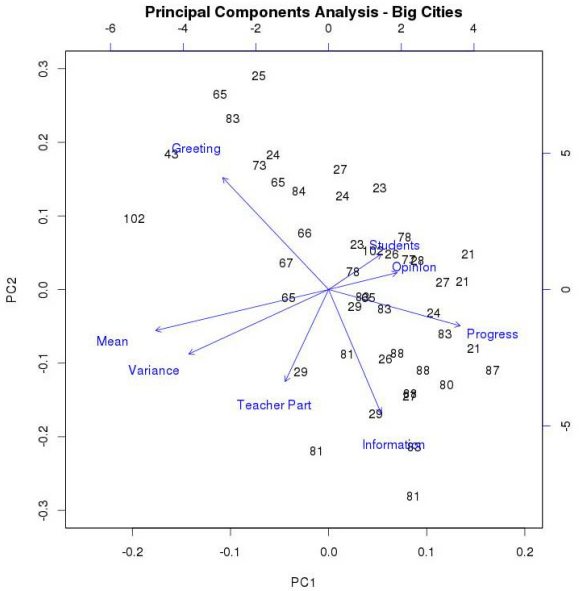

Fig. 3. PCA considering only class groups in urban schools. The main plane represents 41.00% of the data variance.

http appears, suggesting the relevance of the "creativity stage" where they may post more links. We are also interested in visualize the difference between the rural and urban school class groups, and therefore we break the PCA analysis into 2 groups separating the data by the *Location* factor. We present the results of our analyses in Figures 3 and 4. We focus on correlations between one of the three topics —Opinion, Information or Greeting— and the other indicators.

In both cases we observe positive correlations between *Mean* and *Variance*– correlation of 0.69 and 0.75 (urban and rural, respectively)— and negative correlations between *Greetings* and *Opinion* scores –correlation of -0.37 and -0.36 (urban and rural, respectively)— and between *Greeting* and *Information* –correlation of -0.70 and -0.69 (urban and rural, respectively)—. In contrast, different correlations are founded in the following cases:

1. **Urban school:** positive correlations between *Progress* and *Information*– correlation of 0.28— and a weak correlation of 0.16 between *Teacher Participation* and *Information* score, while negative correlations can be observed between *Greetings* and *Progress* —correlation of -0.31—.
2. **Rural schools:** positive correlations between *Teacher Participation* and *Information* score —correlated by 0.57—, between *Teacher Participation* and *Mean* of regularity —with a correlation of 0.55—, and inverse correlations between *Teacher Participation* and *Progress* —with -0.34 correlation.

These results suggest that in both cases (urban and rural) greeting messages take the place of other more advance use of the microblogging space (opinion

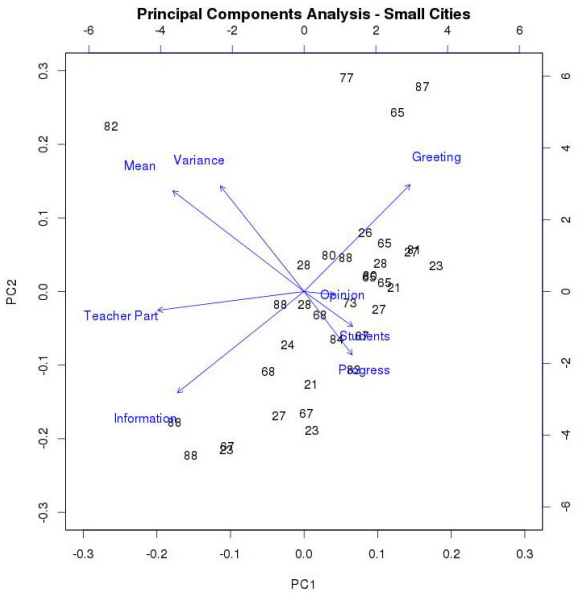

Fig. 4. PCA considering only class groups in rural schools. The main plane represents 40.22% of the data variance.

and information). While *Teacher Participation* relates to *Information* messages in rural areas, in urban areas this relation is weaker. In that case we observe a positive relation between *Information* score and Progress.

6 Conclusion

In this paper we conducted an analysis of microblog posts of middle and high school students in classroom participating in blended (face-to-face and virtual) activities. The Kelluwen project provides didactic designs in different subjects (language, history) which guide teachers and students in didactic activities incorporating social web tools. The Kelluwen platform includes a microblogging tool that students use freely to know each other, share resources or give feedback.

The results obtained with the LDA topic model showed that the messages posted by the students in the micro-blogging tool can be effectively grouped in three main topics: *opinion*, *greetings* and *information*. The information topic is related to the specific content of the different didactic design and this topic is splitted when the process run for higher number of topics: we tested from three to five topics and in all cases we found two distinctive topics corresponding to opinion and greeting messages, while the other topics corresponded to the information of the matters addressed by didactic designs. Because we performed a global analysis considering didactic designs from different subject areas, we decided to consider only three topics in our analysis, where the third topic includes information messages from the different content themes.

With the obtained topics we computed empirical probabilities that a message belongs to one of the three topics and then we related these probabilities with indicators describing each class group. The Principal Component Analysis showed that the degree of *Teacher Participation* positively influences the probability of *Information* messages. *Opinion* messages, on the other hand, are inversely correlated to the *Mean* and the *Variance* of the times between activities, implying that a regular development of the experience influences the tendency to post *Opinion* messages. When we analysed the behaviour of urban class groups, we observed that *Opinion* score is positively correlated to *Progress*, entailing that well executed experiences imply that the students produce more opinion messages, which is probably associated to the reflection about their learning processes.

These results confirm the potentiality of the worklog in various senses. On one hand, we have seen how the worklog is an effective tool for teacher mediation in the learning process: students post more about information or knowledge issues when the teacher is more active in the worklog. On the other hand, if we interpret the *opinion* messages as the results of motivation and reflective processes on the learning activities, we can explain the correlation between *progress* and *opinion* scores, considering that the progress in the learning activities is modulated by the motivation of students.

Finally, results highlight the value of communicative aspects in b-learning experiences: although the teachers have the opportunity to give offline instructions, their participation in the worklog tool establishes a closer communicative relationship with the students (dialogic and horizontal). This can promote motivational aspects and improve the quality of pedagogic scaffolding.

References

1. Abel, F., Gao, Q., Houben, G.J., Tao, K.: Analyzing user modeling on twitter for personalized news recommendations. In: Konstan, J.A., Conejo, R., Marzo, J.L., Oliver, N. (eds.) UMAP 2011. LNCS, vol. 6787, pp. 1–12. Springer, Heidelberg (2011)
2. Arancibia Herrera, M.: La Red Enlaces en Chile. Incorporación de la Informática a la Tareas Pedagógicas: una Historia que Alumbra un Promisorio Futuro. Perspectiva Educacional 36, 133–151 (2000)
3. Blei, D.M., Ng, A.Y., Jordan, M.I.: Latent dirichlet allocation. The Journal of Machine Learning Research 3, 993–1022 (2003)
4. Crook, C.R.: The "digital native" in context: tensions associated with importing Web 2.0 practices into the school setting. Oxford Review of Education 38(1), 63–80 (2012), http://dx.doi.org/10.1080/03054985.2011.577946
5. Ebner, M., Maurer, H.: Can weblogs and microblogs change traditional scientic writing? Future Internet 1(1), 47–58 (2009), doi:10.3390/1010047.
6. Ebner, M., Lienhardt, C., Rohs, M., Meyer, I.: Microblogs in Higher Education - A chance to facilitate informal and process-oriented learning? Computers & Education 55(1), 92–100 (2010)
7. Gao, F., Luo, T., Zhang, K.: Tweeting for learning: A critical analysis of research on microblogging in education published in 2008-2011. British Journal of Educational Technology 43(5), 783–801 (2012)

8. Guerra, J., Sosnovsky, S., Brusilovsky, P.: When One Textbook Is Not Enough: Linking Multiple Textbooks Using Probabilistic Topic Models. In: Hernández-Leo, D., Ley, T., Klamma, R., Harrer, A. (eds.) EC-TEL 2013. LNCS, vol. 8095, pp. 125–138. Springer, Heidelberg (2013)
9. Hepp Kushel, P.E.: ENLACES: El Programa de Informática Educativa de la Reforma Educacional Chilena. In: Cox, C. (ed.) Políticas Educacionales en el Cambio de Siglo. La Reforma del Sistema Escolar de Chile, pp. 419–451. Editorial Universitaria, Santiago (2003)
10. Holotescu, C., Grosseck, G.: Using microblogging in education. Case Study: Cirip. ro. In: 6th International Conference on e-Learning (July 2009)
11. IAB, Cifras del Mercado de Internet en Chile. Informe preparado por Interactive Advertising Bureau Chile (2013), `http://www.iab.cl/estudios-iab/` (revisado March 13, 2014)
12. Inalef, K., Guerra, J., Scheihing, E.: Development and Validation of a Virtual Worklog as a Collaboration Tool for the Kelluwen Learning Community. In: 2012 IEEE 11th International Conference on IEEE Trust, Security and Privacy in Computing and Communications (TrustCom) (2012)
13. Paul, M.J., Dredze, M.: You are what you Tweet: Analyzing Twitter for public health. In: ICWSM (2011)
14. Scheihing, E., Guerra, J., Cárcamo, L., et al.: La experiencia Kelluwen: Tres años de desarrollo y puesta en práctica de una propuesta de innovación didáctica con uso de TIC. Estud. Pedagóg 39, 121–141 (2013)
15. Scheihing, E., Guerra, J., Bustamante, S.: An experience of peer evaluation in a b-learning environment. Paper accepted in EdMedia 2014 (2014)
16. Wright, N.: Twittering in teacher education: reecting on practicum experiences. Open Learning 25(3), 259–265 (2010), doi:10.1080/02680513.2010.512102
17. Yang, X., Ghoting, A., Ruan, Y., Parthasarathy, S.: A framework for summarizing and analyzing twitter feeds. In: Proceedings of the 18th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, pp. 370–378. ACM (August 2012)

A Table of Didactic Designs

At each Principal Component Analysis, points are represented by the number of the Didactic Design instead of their Experience number. Note that some names are repeated, as they are newer versions of other the Design.

Design id	Name (translated)
21	"The literary and non-literary in Youtube"
23	"Panoramic of our world through photograph"
24	"Newsblog"
25	"Greco-latin culture from XXI century blog"
26	"Photographing the biosphere"
27	"Touristic blog of our locality"
28	"Video run: The worlds in literature"
29	"Photographing the Industrial Revolution"
43	"Rebuilding our cultural heritage"
65	"Photographing the biosphere"
66	"Creating a Monarchy through a Blog"
67	"I tell my tale"
68	"A letter has arrived!"
73	"Our magazine of Chilean History"
77	"Blogging opinions, building realities"
78	"Speech of comments and its possibilities"
80	"Touristic blog of our locality"
81	"Photographing the Industrial Revolution"
82	"The literary and non-literary in Youtube"
83	"Video run: The worlds in literature"
84	"Greco-latin culture from XXI century blog"
87	"Newsblog"
88	"Building a Slide-show of the XX Century"
102	"Research blog about Conspiracies"