

# Analyzing the behavior of a teacher network in a Web 2.0 environment

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## ABSTRACT

In this paper, we analyze the interactions in a Web 2.0 platform of teachers from 60 schools integrating the Kelluwen network. This network is a part of a project aimed to introduce the Web 2.0 as a pedagogical tool for the development of socio-communicative skills in middle school students from Southern Chile. Clustering analysis was performed to understand the behavior of teachers in the network. The results allow us to distinguish two major groups. One characterized with a longer execution time of pedagogical activities -compared with the mean case- and the other one characterized by rating participation of their colleagues more frequently.

## Keywords

Clustering analysis, teacher network, Web 2.0

## 1. INTRODUCTION

The increasing number of on-line services supporting teacher activities requires the analysis of their impact on targeted users. There is little information on the use that teachers make in these environments [1]. In the particular case of a teacher network, one of the challenges is to discover the factors that allow the network to grow over the time. Kelluwen network is part of a project aimed to introduce the Web 2.0 as a pedagogical tool for the development of socio-communicative skills, in middle school students from Southern Chile [3]. The network is supported by an on-line platform that provides several services related to the use, development, evaluation, execution and sharing of collaborative didactical designs. In each of these activities, the teachers can interact on the platform with their students, other colleagues and other classes (*twin* classes) which are executing the same didactical design. For instance, in the managing module teachers register the beginning and the end of each activity performed with their students, in the worklog teachers communicate with their students. In the Kelluwen wall teachers interact with other colleagues talking about the shared didactical experiences, etc. The last version of the platform is available at <http://www.kelluwen.cl/app>. In this work, we perform a clustering analysis to discover patterns in teachers according to the interaction activities that they undergo in the Kelluwen platform. Clustering is an unsupervised learning model usually applied in educational data mining for discovering groups of users in the context of e-learning environments [1]. This study applies Latent Class Analysis (LCA) [2], and also the classical K-means clustering algorithm, using procedures of R statistical in both cases. This is a first study of the interactions in this teacher network which intends to discover factors that would allow the Kelluwen community of practice to grow over the time.

## 2. DATA ANALYSIS AND RESULTS

The data from Kelluwen network of teachers executing a didactical design during year 2011 were used in this study. From

this, those who realised less than 20% of any didactical design were excluded. Finally, 55 teachers were considered of a total of 68 teachers registered in the network. We identified nine measures which are related to the principal interaction activities of the teachers in the platform. A first measure is the number of didactical designs executed for each teacher, named  $N^{\circ}DD$  in the analyses. From the *Management module* we computed the mean and standard deviation of time between the beginning of two sequential activities over the didactical designs executed by a teacher (Mean time and SD time respectively). At the *Worklog module*, the teacher interacts with their students and with colleagues from twin classes. Three related measures are defined in this case: Number of messages, number of answers to messages, and rating of messages that a teacher has written in the Worklog, during all the didactical designs executed by her (named Worklog messages, responses and ratings respectively). At the *Kelluwen wall* the teacher interact with their colleagues sharing her experiences in the execution of didactical designs. Three related measures are defined in this case: Number of messages, number of answers to messages, and rating of messages that a teacher has written in the Kelluwen wall, during all the didactical designs executed by her. We named these variables Wall messages, responses and ratings respectively in the analyses.

### 2.1 K-means analysis

To calculate the appropriate number of cluster, we plot the within-groups sum-of-squares by number of clusters extracted. The plot in Figure 1 suggests  $K=5$  or 6.

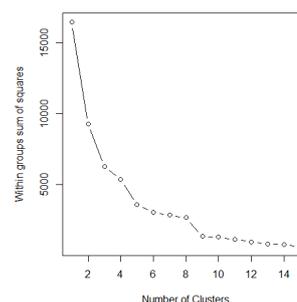


Figure 1: sum of squares within groups as a function of number of clusters in K-means clustering

Using the *kmeans* function from R, we compute the clustering with both values of  $K$  and we plot the obtained clusters jointly with the projection of original variables (red rows) in the principal component plane. Figure 2 shows the obtained clusters for  $K=5$ . There is one main group (4) with 43 individuals without distinctive features. Interestingly, two groups follow a more defined pattern: one group (3) of five individuals who spend more

time between sequential activities, and another group (2) of 3 individuals that use the social services of the platform to interact with other teachers. Two singleton groups are 1 and 5 which correspond to two teacher characterized by an intensive use of the *Virtual worklog*.

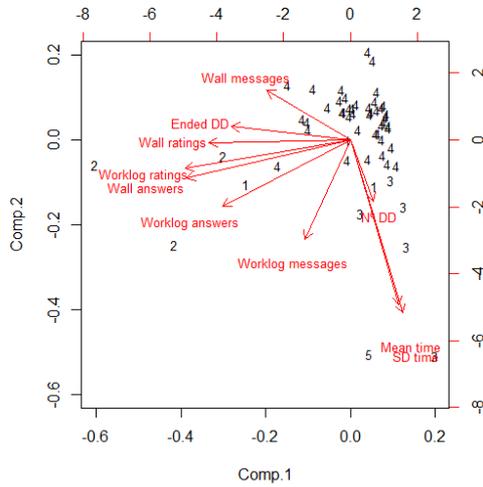


Figure 2: K-means cluster analysis with k=5

## 2.2 Latent cluster analysis

Following [4], we use the function `mclustBIC` from `mclust` package of R to compute different models for latent cluster analysis. Two optimal models satisfying a maximum Bayesian Information Criterion (BIC) are obtained (see Figure 3). Both are multivariate models with independent variables of different variances and equal shape (VEI), with 3 or 4 components in the mixture. The values of BIC are -1943.008 and -1943.832. We select the model with 4 component because is more comparable with the k-means analysis.

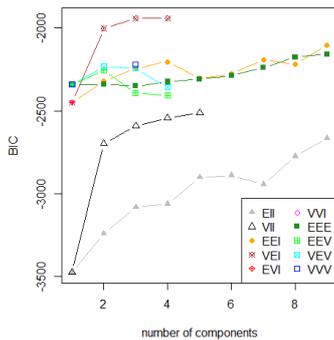


Figure 3: BIC as a function of components in LCA

The corresponding clusters are computed with the `mclustModel` function, which gives a probability to each individual to be extracted from each cluster. We consider values upper 0.5 to assign a cluster to each individual. The resulting clusters are plotted jointly with the projection of original variables (red rows), in the principal component plane in Figure 4. We observe two main groups (2 and 4), with 34 and 12 individuals respectively, without distinctive features, and two other groups of teachers that

follow a more defined pattern: one group (3) of three individuals who spend more time between sequential activities, another group (1) of 6 individuals that use the social services of the platform to interact with other teachers.

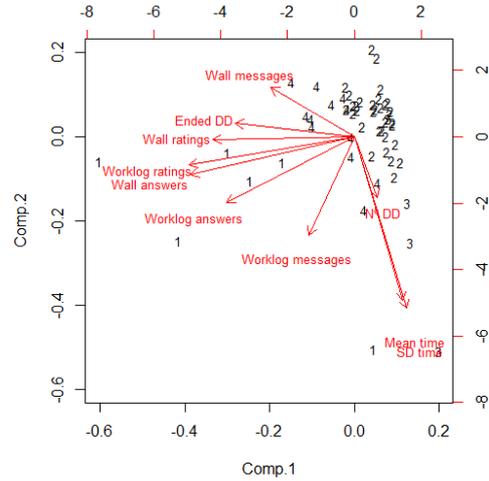


Figure 4: Latent cluster analysis with 4 components.

## 3. CONCLUSION AND DISCUSSION

The Kelluwen network is supported by a Social Web collaborative learning platform which contains meaningful information enclosed in their system dynamics. In this work we performed initial cluster analyses using the teacher interactions in the platform to characterize their behavior. The results in both analyses show a major group of teachers more or less homogeneous and two secondary groups with some key features. One of them characterized with a longer execution time of didactical activities -compared with the mean case-, and the other one characterized by rating participation of their colleagues more frequently. Furthermore in the principal component plane, both features are represented as orthogonal. This finding allow us to hypothesize that the more the teacher uses the Web 2.0 services of the Kelluwen platform, the more regular is her behavior executing the didactical design.

## ACKNOWLEDGMENTS

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