Exploring Social Network Analysis in Blended Learning Teacher Training Programs

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Abstract

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Learning Analytics is an educational application of web analytics and it is used to analyze the learners' activities on educational platforms, in order to predict their behaviour. Learning Analytics reflects a field at the intersection of numerous academic disciplines and is using different methods like: statistics, visualizations, data/web mining, and social network analysis.

Social network analysis aim is to discover patterns in individual interactions. Network analysis is based on the intuitive notion that these patterns are important attributes of the individuals' lives. The social network analysis can be made with different software applications and it's very important to support networked learning.

Learning Analytics tools for social network analysis are providing a framework for interpreting and developing an understanding of the observed patterns of exchanges that occur between social actors.

The on-line / blended educational programs from the last decades have collected an enormous quantity of data. These data include initial evaluation information, data from the training process and results of the training program. These data can be used to validate the learning analytics theory.

Since the definition and purpose of learning analytics is still disputed, comparing the predictions results obtained on the basis of initial data with the final results obtained by learners can contribute to the validation of such applications. This article present the findings and conclusions obtain after analyzing series of forum posts on the educational platforms used in teachers training programs.

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Keywords: Learning analytics; social network analysis; teachers training; educational platforms.

1. Introduction

Learning analytics is an educational form of web analytics that aim to measure, collect, analyze and report data about learners and their context in order to optimize the environment in which occur. According to Ferguson (2012), "*learning analytics is an emerging field in which sophisticated analytic tools are used to improve learning and education. It draws from, and is closely tied to, a series of other fields of study including business intelligence, web analytics, academic analytics, educational data mining, and action analytics*".

Business Intelligence focuses on computational tools to improve organizational decision-making through effective fusion of data collected via various systems. This term is well-known for transforming big quantity of data into decision making capabilities.

Data Mining is the field concerned with employing large amounts of data to support the discovery of novel and potentially useful information. From data mining was developed the field of Educational Data Mining (EDM) "*an emerging discipline, concerned with developing methods for exploring the unique types of data that come from educational settings, and using those methods to better understand students, and the settings which they learn in*" (Baker, & Yacef, 2009) cited by Buckingham, & Ferguson (2012).

Even if some authors are considering that *Learning Analytics and Knowledge* (*LAK*) and *Educational Data Mining* (*EDM*) are similar fields, there are many differences between the two fields. Siemens & Baker (2012) made a comparison of the LAK and EDM. EDM has strong origins in educational software and student modelling, has a greater focus on automated adaption and use technique and methods like: classification, clustering, Bayesian modelling, relationship mining, discovery with models, visualization. LAK has stronger origins in semantic web, intelligent curriculum, outcome prediction, systemic interventions, has a greater focus on informing and empowering instructors and learners and use techniques and methods like: social network analysis, sentiment analysis, influence analytics, discourse analysis, learner success prediction, concept analysis, sense making models.

Dringus (2012) consider that Learning Analytics require a set of conditions when are applied in online courses: must obtain meaningful data, must have transparency, must yield from good algorithms, must lead to responsible assessment and effective use of the data trail, must inform process and practice.

2. Social Network Analysis

Networked learning involves the use of ICT to bring together learners, tutors, learning communities and educational materials. "*Social network analysis is a perspective that has been developed to investigate the network processes and properties of ties, relations, roles and network formations, and to understand how people develop and maintain these relations to support learning*" (Haythornthwaite, & de Laat, 2010) cited by Buckingham, & Ferguson (2012).

The results of a social network analysis might be used to: (a) identify the individuals and teams that play an important role; (b) discover information disturbs, isolated individuals and teams; (c) emphasize

opportunities to accelerate knowledge flows across functional and organizational boundaries; (d) strengthen the efficiency and effectiveness of existing, formal communication channels. (e) increase awareness on the importance of informal networks. (f) mutual support; (g) improve innovation and learning; (h) improvement strategies (Serrat, 2010).

Social network analysis is a useful tool for investigative online learning because of its focus on the change of interpersonal relationships, and offers the potential to recognize interventions that are possible to increase the potential of a network to support the learning of its actors by relating them to contacts, resources and ideas.

3. Methodology

3.1. The sources of analyzed data

The on-line / blended educational programs from the last decades have collected an enormous quantity of data. These data include initial evaluation information, data from the training process and results of the training program. These data can be used to test and validate many subjects of the learning analytics theory.

Since the definition and purpose of learning analytics is still disputed, comparing the predictions results obtained on the basis of initial data with the final results obtained by learners can contribute to the validation of such applications.

Three educational projects implemented at national level in Romania were selected as source of initial data. These projects have supported blended courses for teachers training. Table 1 present the name of the projects, their acronyms and the version of the educational platform used in online course. The online courses were conducted during different number of months and in the frame of the courses, the learners participated in discussion forums.

Table 1. Sources of analyzed data.

No.	Project name	Number of users	Educational Platform	Version
1	Training System for Teachers to Increase Efficiency of ICT Use and Quality Assurance of Computer-Assisted Instruction in Primary and Secondary Schools – EDUTIC (POSDRU/19/1.3/G/37002)	850	Moodle	1.9.9+
2	Professionalizing teaching career - new competencies for actors of changes in education in Dambovita and Buzau counties – FOREDU (POSDRU/87/1.3/S/62624)	2600	Moodle	2.0.3+
3	Network for training teachers to use multimedia, virtual instrumentation and web 2.0 in curriculum of Mathematics and Natural Sciences – PROWEB (POSDRU/157/1.3/S/141587)	1500	Moodle	2.6.4+

3.2. SNAPP Software

SNAPP (*Social Networks Adapting Pedagogical Practice*) is a social network analysis tools, that renders a social network diagram from the extracted forum interactions. This software was developed to work with forums from specific learning management system: *Moodle*, *Blackboard* and *WebCT*. The social network map provides an overview image of the users that communicate each other and the level of their communications. The software represents each forum participant by a node, and interactions

between participants are characterized by a line. The number displayed on the line represent the number of posts between two nodes.

According to Dowson et al. (2010), a network diagram of the students' online conversation can provide useful information such as: (a) highlights the disconnected students; (b) reveals students who provide information to other students in the course; (c) show if it forms a learning community within the course and how big is it; (d) allow students to benchmark their performance without the need for marking; (e) allow identification of potentially high and low performing students in order to take action before mark their work; (f) provide a snapshot before and after a teacher changed the learning activity design.

4. Results and discussions

SNAPP software was used to analyze several discussion forums from the educational platforms of the three projects mentioned above. An attempt was made to identify disconnected learners, those with outstanding performance, information brokers and internal groups. SNAPP statistics is displaying the list of forum participants, beginning with the most active users and ending with the less active users of the analyzed forum.

To identify the disconnected learners, most active learners and learning groups inside the course, it was analyzed the social network diagram. The disconnected users are represented by nodes at the edge of the chart. Central node represents the information-broker in that forum and the interconnecting lines are marked with the number of posts of those users.

Using the same methodology, several discussion forums from the ForEdu, EduTic and ProWeb projects were analyzed. For the two projects (ForEdu and EduTic), it was compared the list of the most active users and the list of the less active users with their learning results in the frame of the teaching program. It was noticed that the results do not show the real relationship between the data presented in the social network diagram and the learners' final course results. Although, it was confirmed the initial theory that usually the disconnected users (from the diagram) are obtaining weaker results, there are also contradictory situations.

4.1. Working with other software and data

The work presented above had as main purpose to find opportunities and solutions to implement *Social Network Analysis* in an on-going project - the European FP7 Project called: *ENGAGE - Equipping the Next Generation for Active Engagement in Science Project*, that run online courses for teacher training programs, particularly, the online course "*Methods of promoting Responsible Research and Innovation dimensions in Science Education*", organized by Valahia University Targoviste, for in-service science teachers, in 2015.

The Engage project (https://www.engagingscience.eu) has the main objective to make Science lessons more attractive, taking into account the promotion and implementation in the classroom of different interactive-participatory teaching strategies, based on involvement and reality investigation, identifying and testing alternative solutions, which target to let young students to think and apply their

scientific knowledge, and consequently to make responsible decisions, in accordance to Responsible Research and Innovation dimensions (Petrescu et al., 2015).

In the frame of the Engage project, *Learning Analytics* represents an important subject for study and research. In this project, the online courses are hosted on a *MOOC* (*Massive Open Online Course*) platform: *open edX*. The project maintains a community of learners and provide access to a *Knowledge HUB* - a centralized portal for open educational materials, blog, videos and other resources.

Open edX provide some tools for learning analytics, but at the moment, do not offer a tool for social network analysis. At the same time, the SNAPP tool is incompatible with the discussion format in the open edX platform.

Conclusions

During the research, some challenges and issues were identified: technical issues on running the SNAPP software, but also challenges for correct interpretation of the obtained data. Even if the used educational platform was Moodle, the SNAPP software didn't work on the data recorded in the forums of the ProWeb Project. The application is parsing the ProWeb discussion forums but it is reporting zero posts.

Also, it was identified a number of difficulties in using application analysis software. In large forums it is complicated to analyze the social network diagram. Using too many forums it will make very difficult the analysis.

The results obtained are not very conclusive. In general, the active students in the forums obtained good evaluation results and some inactive students didn't finish the training program. There are also an important number of students inactive in forums who obtained good results at final evaluations and they completed the training program. This can be explained by the profile of the Romanian teachers. They have to apply for teacher training programs in order to obtain the required number of credits and they do not have time also for course additional activities. For these reasons, they are focused on accomplishing the tasks and assignments, and not getting involved in forums' discussions.

It can be noticed that in order to obtain better results, the social network analysis must be combined with some other learning analytics techniques.

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