

Efficiency Evaluation of Using Social Networks Application in the University E-Learning System

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Abstract. The paper studies the possibilities of social networks application within the university system of e-learning. The advantages and disadvantages of social networks application have been analyzed. Necessity and expediency of social networks application in the course of students' learning process have been grounded. The paper studies the efficiency of this process. Measures for improving the efficiency of social networks application in the university e-learning system have been developed.

KEYWORDS: Social Networks, University E-Learning System, Distance Learning, Facebook, Instagram, V Kontakte.

1 Introduction

Under modern conditions, high use of social networks has penetrated into every area of modern human life. And a sphere of education is no exception [1-5]. The major advantage of social networks (SN) use as a universal means of communication is the extension of the social circle. If in the course of communication users share experience, spread information that can be useful for learning purposes, discuss learning topics with their teachers or among themselves, master new techniques and educational media, then the benefit of SNs is obvious. SNs make it possible to take online courses at a convenient pace, discuss educational course content and clarify challenging issues in chats and on forums.

According to the research carried out by the international organization «Wearesocial», there are almost 26 million active Internet users in Ukraine (that is 58% of the entire population), 23 million of which log in to SN at least once a month (2018) [6].

These are the most popular social networks in Ukraine:

- Facebook (13 million users);
- Instagram (7,2 million users);
- Twitter (1,6 million users);
- LinkedIn (up to 1 million users).

It is also expedient to mention two Russian SNs: VKontakte (VK) and Odnoklassniki (OK). The popularity of these networks has been decreasing significantly since 2014 especially after their blocking in 2017.

Given the fact that social network is a complex social structure [7, 8] that consists of social objects (users), interrelated by way of social relations, the process of SN functioning may be considered in two planes: applied (associated with solving specific applied problems) and theoretic (creation and study of network model of users). The theoretic plane makes it possible to examine the complexity of interrelations within SN, which can take various forms: from superficial communication to learning information exchange for the purpose of self-development and professional growth. Investigation of SN practical plane [9-13] makes it possible to analyze their applicability as an additional motivational and communicative tool within the system of university e-learning. University e-learning system is free of charge and fully open learning management system, with a focus on the development of the cooperation between university teachers and students; it is based on the use of the ELMS Moodle platform (Modular Object-Oriented Dynamic Learning Environment). Moodle [14-16] system has a wide selection of functionality commonly found in e-learning platforms, course management systems (CMS), learning management systems (LMS) or virtual learning environments (VLE). The basic advantage of Moodle is that this web service affords an opportunity to create efficient websites for online learning [17-19]. Consistency, evaluation criteria and indicators of efficiency and reliability of systems and processes are discussed in [20-22].

The following researchers deal with the issue of electronic learning: Bersin J. Rapid, D. Bernhard, B.W. Boehm, I. Gurevych, Mark-Christoph Muller, D. Patarakyn, E. Polat and others [1-7, 14, 15]. The following national and foreign research workers and experts deal with the issue of SN application in students' learning activity: N. Basaraba, I. Gurevych, H. Colley, S. Zhigang, M. Muhlhauser, D.W. Livingstone, Y. Steimle and others [4-5, 14]. A lot of national researchers are interested in psychological and pedagogical aspects of this process, namely H. Dichanz, C. Jones, J. Knight, T. Rekkedal, S. Qvist-Eriksen and other. The following researchers are interested in managerial and technical aspects: B. Boehm, C. Abts, A.W. Brown, S. Chulani, B.K. Clark, E. Horowitz, R. Madachy, D. Reifer, B. Steece [18-21]. As we can see, the given issue is complex, topical and calls for study and research.

2 Research Goals

The purpose of the article is to study the possibilities of SN application in the university system of e-learning. In order to achieve this objective, it is necessary to work out the following tasks:

- an analysis of the advantages and disadvantages of SN application;
- grounding the necessity and expediency of SN application in the students' learning process;
- defining SN popularity for storing links, exchanging links to educational materials among students and university teachers;

- the study of the efficiency of SN application in the university e-learning system;
- the development of measures for improving the efficiency of SN application in the e-learning system.

3 Efficiency Evaluation of Using Social Networks Application in the University E-Learning System

3.1 Advantages of SN Application within the University E-Learning System

As it was mentioned previously, the basic SN feature, advantage and purpose are that they are universal means of communication. The opportunity of networking and establishing contacts among users (in synchronous and asynchronous modes, in comfortable conditions and in accordance with user needs), the possibility of applying a wide range of technical and methodic tools as well as other substantial advantages particularly make SN an efficient instrument for enhancing the learning process efficiency.

As far as social learning is concerned, it is expedient to shift emphasis from the academic discipline content to the interaction between students and teachers, because the content is intended for them.

An analysis of SN opportunities allows identifying advantages of their application in the university electronic learning environment:

- availability of tools for storing useful bookmarks and tools for storing useful links to websites by applying the system of tags;
- possibility of storing, grouping and exchanging digital photos, audio and video recordings, text files, presentations;
- possibility to organize a discussion of resources (individual, group or public);
- possibility to choose one's own time frame for studying the learning material as well as learning pace;
- blogging or website promotion;
- free use of Internet services;
- interaction during the learning process;
- possibility to form user groups and communities in order to solve certain problems or tasks;
- fast information retrieval.

3.2 Component Parts of SN Application Efficiency in the University E-Learning System

Following the analysis of SN advantages, let us single out five component parts of the integral efficiency indicator of social network tool application in the learning process in particular:

- managerial – characterizes the level of user interconnection organization in the social network during the e-learning process, access to relevant information, self-development and network openness;

- social and psychological – highlights the level of emotional perception of information, user motivation, tolerance towards opposing opinions, self-expression possibility, etc.;
- learning – characterizes the level of learning efficiency of the system, mastering learning material, use of multi-media and visual aids, achieving pedagogic objectives, developing creative and professional skills, etc.;
- technologic – highlights application level of hardware in the course of e-learning, methods and techniques for learning and familiarization with the learning material, mastering and discussion of learning material, consultations on their application in professional activity;
- economic – characterizes ratio of achieved economic results, impact, and benefits to costs associated with achieving this effect and attracted resources.

3.3 Evaluation Criteria of SN Application Efficiency in The University E-Learning System

Accordingly, we consider it expedient to select the following principal criteria that allow us to evaluate the managerial efficiency of SN application in the university e-learning system:

- network dynamism;
- information visualization level;
- interactivity (as the level of communication between users);
- accessibility;
- openness;
- choice of convenient interaction mode (synchronous or asynchronous);
- network self-development;
- the autonomy of network nodes;
- system of tags;
- ease of networking technology use;
- horizontal links;
- decentralization.

Criteria for investigation of the social and psychological component part of SN application efficiency in the university e-learning system include:

- level of information perception;
- solidarity and critical thinking;
- emotiveness of communication and information representation;
- various nature of communication;
- motivational constituent;
- intellectuality, creative potential;
- the autonomy of users as Internet activity;
- self-identification and instant view of information grouping;
- tolerance towards opposing opinions;
- self-expression possibility;
- anonymity;

- voluntariness.

Criteria of learning component part of SN application efficiency in the university e-learning system may include:

- use of multi-media visual aids;
- communicativeness;
- efficiency;
- individuality;
- activation of cognitive, reflexive and independent activity;
- variability of learning tasks and extracurricular work;
- pedagogic effect (patriotism, development of attention, mental flexibility, work planning skills, tidiness, etc);
- development of professional skills;
- promotion of creative and professional activity;
- the opportunity to choose and combine forms of interaction.

It is expedient to select the following criteria of the technologic component part of SN application efficiency in the university e-learning system:

- level of technical implementation of interaction;
- virtual nature;
- adaptability;
- level of hardware application;
- range of methods and techniques for learning and familiarization with the learning material;
- level of organization of the process of learning material discussion in order to clarify areas of concern and get consultations.

Given the fact that economic component part of SN application efficiency in the university e-learning system is a summarizing indicator characterizing the ratio of economic benefit from a certain type of activity to costs or resources, attracted in order to achieve this effect, there are the following evaluation criteria for it:

- the efficiency of mastering the learning material, gaining professional skills and knowledge;
- amount of costs associated with the process of e-learning;
- reliability of SN application in e-learning;
- quality of learning material and educational services as far as e-learning with the aid of SNs is concerned;
- competitive ability of e-learning with the application of SN tools;
- optimality of such learning;
- level of flexibility of requirements and main indicators;
- economic benefit and expediency;
- cost-effectiveness of learning.

3.4 Investigation of Generalized Evaluation of SN Application Efficiency in the University E-Learning System

Having applied an integrated approach, it is possible to obtain a generalized evaluation of SN application efficiency in the university e-learning system in a whole by means of generalization of indicators that encompass all the most important component parts of this efficiency. Thus, the general indicator of efficiency (E_{gen}), according to the integral approach, is determined using the following formula:

$$E_{gen} = f(E_1, E_2, \dots, E_i, \dots, E_n) \quad (1)$$

where E_1, E_2, E_3, E_4, E_5 are the component parts of efficiency indicator of SN application in the university e-learning system, namely: managerial, social and psychological, learning, technologic and economic component parts [22-24].

The primary objectives of e-learning application by the national higher education institutions are the following: simplification of access procedure to all the necessary learning materials for students, organization of individual work with electronic resources, receiving consultations, discussing areas of concern, another possibility to get grades, development of distant cooperation, etc.

3.5 Peculiar Features of the University E-Learning System and Conditions of its Investigation

In the course of the investigation of SN application by students and university teachers, we carried out an analysis of going from SN and other websites to the website of active ELMS on the basis of Moodle open source software.

Moodle software is available on the university web-server at <http://vns.lpnu.ua>.

In order to perform the analysis, we selected the time period before the session with maximum daily traffic. In 2018 the period of 91 days was selected (dates from Sep 23, 2018 to Dec 22, 2018).

Data collection and analysis tools regarding user activity – built-in statistics analysis tools Moodle and GoogleAnalytics service.

Investigated ELMS has more than 30000 registered users (university students and teachers). There are up to 28000 students out of the total number of users.

University ELMS is not accessible to unauthorized users [20, 21]. Authentication is required in order to get access to any internal pages, including academic discipline content. Anonymous users have access only to the Login page. The consequence of ELMS privacy is a complete absence of SN to ELMS links from those who do not have access to relevant Moodle pages.

There was no advertising activity in SNs in order to promote vns.lpnu.ua website pages, attract new users and so on. Absence of vns.lpnu.ua website promotion as well as no ELMS access to unauthorized users allows us to determine the interest of ELMS users in spreading web links to learning discipline pages within Moodle environment, tests, and other learning resources.

There are no special advertising campaigns in SNs aimed at the promotion of a website or certain website content, pages with learning resources or user profiles in Moodle.

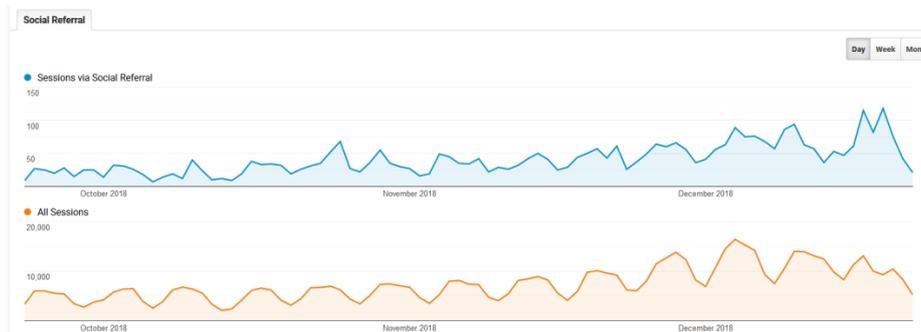


Fig. 1. Comparison of general ELMS website traffic and sessions of users started via SN referral

Figure 1 presents the comparison of the number of sessions (traffic) of the ELMS website (lower graph) and the number of sessions of ELMS users that continued to ELMS website from SN (upper graph).

Weekly activity cycles of users are visible in both graphs. Within a week minimum number of sessions generated via SN referral falls on Saturday and Sunday. The highest weekly activity of users is observed in the middle of the week (Tuesday, Wednesday).

Over a period of investigation, we observe an increase in the website traffic before the examination period for students. In the last days of the investigation period most exams are over, so the number of website user sessions and SN referral decreases.

3.6 The Activity of SN Users in the E-Learning System

According to the findings of vns.lpnu.ua website traffic investigation over a period of Sep 23, 2018 – Dec 22, 2018, the following numbers have been obtained: a general number of sessions – 673944; viewed pages – 8049065.

Table 1. Traffic sources to the ELMS website

| Source type | Number of sessions | Pageviews |
|---------------------------------------|--------------------|-----------|
| Search engines | 416462 | 5261242 |
| Undefined | 245575 | 2635762 |
| SNs and messengers | 3815 | 50365 |
| University websites | 2953 | 42435 |
| VNS and university internal resources | 2611 | 28500 |
| Other websites | 2582 | 30761 |

Table 2. The activity of ELMS users via SN referral

| Source type | Number of sessions | New users | Viewed the learning course | Pageviews |
|---|--------------------|-----------|----------------------------|-----------|
| Facebook | 3035 | 521 | 1532 | 39044 |
| University websites | 2953 | 251 | 1740 | 42435 |
| VNS and university internal resources | 2611 | 37 | 1572 | 28500 |
| Vkontakte | 481 | 43 | 320 | 7294 |
| Instagram (including Instagram Stories) | 205 | 162 | 67 | 2477 |
| Messenger | 94 | 5 | 53 | 1550 |
| Instagram Stories | 8 | | | 47 |
| Other websites | 2582 | 99 | 1560 | 30761 |

Analysis of the geographic location of ELMS and SN users is presented in Table 3.

Table 3. Geolocation of users

| Social networks | Country | Sessions | Pageviews |
|-------------------|----------------|----------|-----------|
| Facebook | Ukraine | 2871 | 37705 |
| Vkontakte | Ukraine | 454 | 8099 |
| Instagram | Ukraine | 201 | 1887 |
| Facebook | United States | 53 | 53 |
| Facebook | Poland | 50 | 313 |
| Vkontakte | United Kingdom | 22 | 213 |
| Vkontakte | United States | 13 | 36 |
| Vkontakte | Russia | 9 | 11 |
| Facebook | India | 8 | 8 |
| Facebook | Turkey | 8 | 80 |
| Vkontakte | Germany | 8 | 46 |
| Facebook | United Kingdom | 7 | 13 |
| Instagram | Poland | 7 | 88 |
| Facebook | Netherlands | 4 | 18 |
| Instagram | Germany | 4 | 19 |
| Instagram Stories | Ukraine | 4 | 8 |
| Facebook | Germany | 3 | 20 |
| Facebook | (not set) | 3 | 12 |
| Vkontakte | Hong Kong | 3 | 30 |
| Facebook | Canada | 1 | 4 |

| Social networks | Country | Sessions | Pageviews |
|-------------------|----------------|----------|-----------|
| Facebook | Italy | 1 | 1 |
| Facebook | Russia | 1 | 7 |
| Instagram | Azerbaijan | 1 | 1 |
| Instagram | Canada | 1 | 3 |
| Instagram | France | 1 | 1 |
| Instagram Stories | United Kingdom | 1 | 1 |
| VKontakte | Netherlands | 1 | 1 |
| YouTube | Ukraine | 1 | 1 |

Omitting unsuccessful ELMS login attempts, we receive the characteristic of users presented in Figure 2.

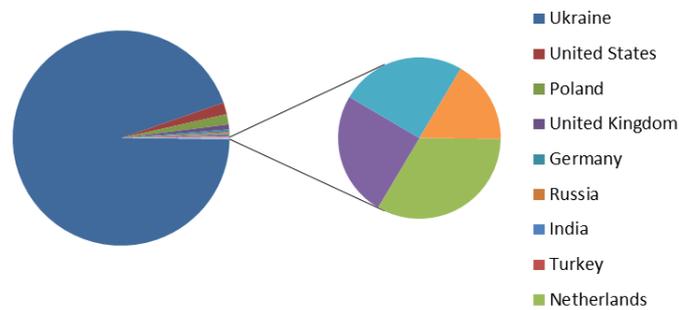


Fig. 2. Geographic distribution of SN and ELMS user sessions

It also should be noted that VKontakte users may use the IP address change technique, VPN and various types of proxy. The indicated number of VKontakte users in table 2 and figure 2 corresponds not to the users from Ukraine but to the users from the other countries.

3.7 Analysis of Landing Pages of SN Users

Analysis of ELMS pages to which SN users go allows defining certain page types and their popularity as a target of SN users.

Table 4. Number of SN user sessions for landing pages of different types

| Page type | Session count |
|-----------------------|---------------|
| site main page, login | 2835 |
| course/view | 282 |
| content (folder, ...) | 158 |
| test, quiz | 128 |
| user report (Grade) | 81 |

| Page type | Session count |
|--------------------------|---------------|
| user homepage | 75 |
| course/category | 61 |
| user profile, password | 41 |
| enrolment options | 27 |
| forum, message etc | 24 |
| other pages | 10 |
| Total number of sessions | 3722 |

Table 5. Number of landing pages of various types for SN users

| Page type | Page count |
|------------------------|------------|
| site main page, login | 35667 |
| test, quiz | 4511 |
| course/view | 2830 |
| content (folder, ...) | 1473 |
| user homepage | 1448 |
| user profile, password | 947 |
| course/category | 706 |
| user report (grade) | 412 |
| forum, message etc | 368 |
| enrolment options | 250 |
| other pages | 204 |
| Total number of pages | 48816 |

Analysis of switching from SNs to the ELMS Moodle page demonstrates that 27% of switches are associated with interior website pages, 73% are switches to the homepage or login page etc. As far as internal pages are concerned, tests and pages with discipline resources are the most popular (18% in total).

4 Conclusions

The paper presents the analysis of ELMS educational website utilization by SN users. Popular SNs among ELMS users of Lviv Polytechnic National University have been defined. The analysis of the popularity of ELMS resources among SN users has been performed. It is significant that students are receptive to all the innovations associated with the use of a well-known SN sphere for learning purposes. They spend a large part of their lives in SNs. For many of them, SNs combine rest, communication and possibility to show themselves and events from their life. Therefore, this sphere is associated with positive emotions and experience. That is why a combination of SN

with learning (a sphere that involves making efforts and time consumption) ensures the educational effect and improves learning process efficiency.

SN application within e-learning system will allow the students to:

- choose a convenient way of communication with a teacher;
- choose place and time for learning;
- choose a method of high-quality knowledge acquisition;
- have a chance to maintain constant contact with a teacher;
- benefit from personalized learning schedule;
- save time;
- reduce education costs.

Combination of SN and university e-learning system has the biggest number of advantages when distance education of students is concerned. It has been a long time since distance education gained approval abroad owing to its peculiar features. However, a lack of direct communication between the student and the teacher is a considerable disadvantage of such a form of education. Nevertheless, this drawback may be easily eliminated with the help of technologies that make such communication both real and constant. The student may ask a question any time and receive an answer.

The undertaken studies define SN popularity for storing links, exchanging links to educational materials among students and university teachers. Facebook turned out to be the main social network while using ELMS website resources. Other networks and popular resources are scarcely used for the distribution of links to university electronic learning resources.

The research has shown that networking social services do not have a significant impact on user access learning resources in the university ELMS. The majority of visitors use other search engines and network resources to access ELMS and specific pages with learning material. The issue of advertising ELMS materials in SNs, aimed at improving the quality of learning, is expedient for further study.

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