

Using Twitter in Ukrainian sociology majors training

Liubov F. Panchenko¹[0000-0002-9979-0625], Andrii O. Khomiak¹[0000-0002-6661-4510] and
Andrey V. Pikilnyak²[0000-0003-0898-4756]

¹ National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”,
37 Peremohy Ave., Kyiv, 03056, Ukraine

lubov.felixovna@gmail.com, andrii.khomiak@gmail.com

² Kryvyi Rih National University, 11 Vitalii Matusevych Str., Kryvyi Rih, 50027, Ukraine
pikilnyak@gmail.com

Abstract. The article deals with the problem of using cloud technologies in the training of sociology students in Ukraine. The popularity of Twitter in Ukraine is analyzed. The possibilities of using Twitter as a learning tool in classroom are discussed. List of recommended tweeters, including Ukrainian resources as well as resources related to population censuses is proposed. The article offers examples of student activities for Social Statistics and Demographics courses. The article demonstrates that new forms of student’s activity related to data analysis introduced by academics and practitioners (building art objects and storytelling based on data; shared data collection by citizens through mobile devices, “play with data” modern data visualization services) can be realized with Twitter resources and can help overcome the barriers that arise while studying quantitative methods.

Keywords: cloud technologies, data visualization, social statistics, demographics, training of sociology majors, Twitter.

1 Introduction

1.1 Problem statement

In the modern digital globalized world, it is becoming more and more important to train sociology students in the field of social and demographic statistics based not only on social and demographic theories, but also on the practical application of the new computer tools and technologies, databases and Internet services [10; 12].

In recent years, educators from various disciplines have investigated ways to incorporate learning materials with a range of different technologies, especially the use of social media in courses. The accessibility of the various forms of social media provide educators with great opportunities and valuable platforms to interact and engage with students, to develop their critical thinking.

A promising area in the field of social media in education is Twitter. This service remains one of the most popular network for researchers and educators in the field of education as well as social and political sciences [1; 2; 6; 7; 8; 15].

The popularity of Twitter in Ukraine is shown in Fig. 1-2.

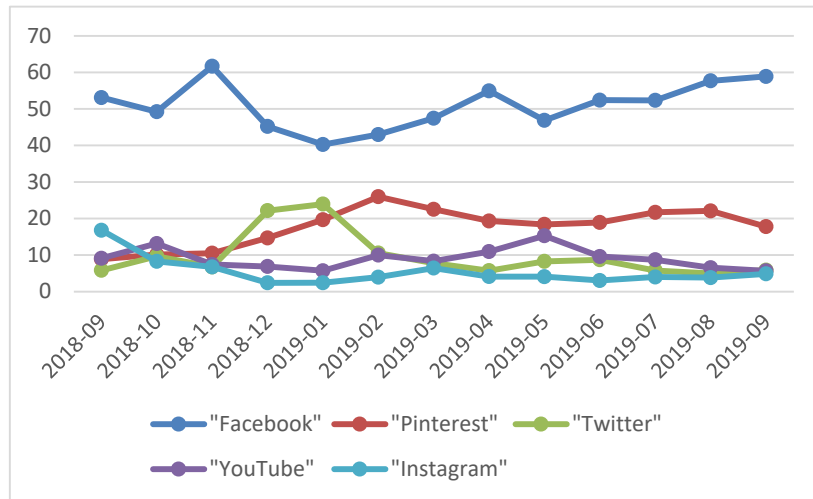


Fig. 1. Social media in Ukraine over the last year, % of users (according to [16])

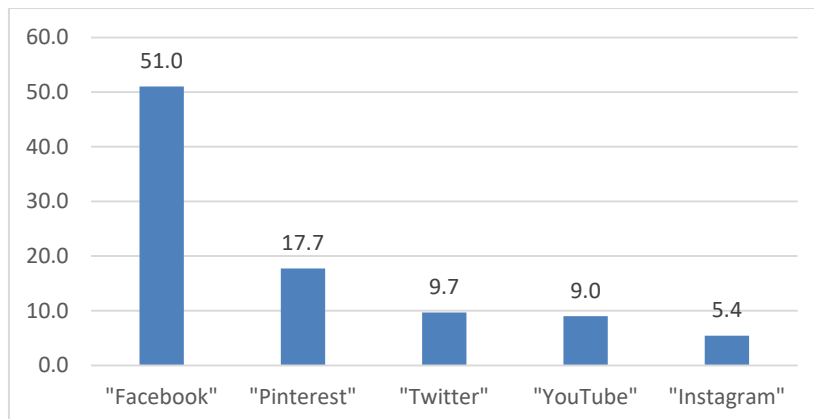


Fig. 2. Social network users in Ukraine, on average from September 2018 to September 2019, % (according to [7])

Consequently, we consider Twitter a very interesting and important tool to use it together with other cloud technologies in the training of sociology majors.

While solving the scientific problem of using cloud technologies in the training of sociology majors in the field of social statistics the following main results were obtained in past author works.

Our paper [9] analyzes the didactic capabilities of one of the cloud data visualization tools – Tableau; suggests a mixed form of data visualization training for sociology majors in the field of social and demographic statistics, based on combining the online course “Social Statistics and Demographics” and fragments of massive online open

courses, in particular, specialization “Data Visualization with Tableau”, offered on the Coursera platform. The possibilities of interactive panels (dashboards) for presenting the results of course work in the field of social statistics and demographics are discussed.

Our article [13] analyzes the capabilities of modern computer tools for the analysis of demographic processes and structures in training sociology students; substantiates the use of the R environment as a tool for analysis and graphical representation of demographic data; presents the idea of teaching students to perform computer analysis of demographic data using a combination of Excel spreadsheets, SPSS statistical package, R environment. In addition, the article presented the didactic capabilities of the free Gapminder service that includes the list of the tools titled ‘Play with Data’, bubble chart, maps, ranking, trends, age pyramids, that provide colorful and dynamic data visualization for chosen demographic criteria by countries and continents in time that stimulates the students to perform additional scientific research.

In preparing specialists in the field of social statistics an important point is to select or obtain the real data sets that are modern and actual to engage the students. The Twitter as an educational tool gave such opportunities [2; 3; 6]. In addition, custom packages of R environment allow to extract information from a tweet (for example, from the Twitter of the US President) and analyze the data using various methods.

The aim of the article, based on the scientific sources is to propose different kinds of student activities for Social Statistics and Demographics courses with the help of Twitter.

1.2 Analysis of recent research and publications

The methodology of using social media in education, in particular Twitter, has received wide recognition in the global community.

George Siemens proposed connectivism as a learning theory for the digital age [15]. Dhiraj Murthy has analyzed the theoretical aspects of sociological understanding of Twitter as a social media [8].

A guide for academics and researchers about using Twitter in university research, teaching and impact activities is presented in [7].

Authors of work [6] develop an accurate and reliable data processing approach for social science researchers interested in using Twitter data to examine behaviors, attitudes, the demographic characteristics of the populations expressing or engaging in them; they discuss also how social media data may benefit demographic researchers.

The possibilities of using Twitter as a learning tool in classroom are discussed in [1].

Mark Ferris and Sherri Cheng [2] explored how Twitter could be used in the introductory business statistics course to achieve goals including improved student learning experiences, more interaction and engagement, stronger connection with the real world applications, and enhanced statistical literacy, reasoning and thinking skills among students.

Unfortunately, in Ukraine, Twitter is not sufficiently used in educational and social studies in general, and in the training of sociology majors at universities, in particular.

2 Results of the study

Twitter is a microblogging platform that allows users to record their thoughts in 140 characters or less. Here is a summary of global Twitter statistics for 2019 [5].

- There are 330 million monthly active users and 134 million daily active users on Twitter.
- 63% of all Twitter users worldwide are between 35 and 65.
- The ratio of female to male Twitter users is roughly one to two: 34 % female and 66% male.
- The average session on Twitter is 3.39 minutes.
- There were 11,7 million downloads of Twitter on the App Store in the first quarter of 2019.
- 75% of B2B businesses market their products and/or services on Twitter.
- 500 million tweets are sent out per day.
- 40% of Twitter users carried out a purchase after seeing it on Twitter.

In our work [11] we discussed the issues related to the formation of student's data literacy. Concept of adult's data literacy develops over time. Currently, it is not enough to prepare only critical consumers of statistical information, the emphasis is on the effective approach, the ability to produce data, as well as understand the properties of big data, algorithms for processing and presentation to consumers, ethical implications and data privacy issues. In this context training of teachers who teach mathematics related disciplines for higher educational institutions becomes crucial. The problems of such training are discussed by Ukrainian scientists in [14; 18; 19; 20; 21; 22; 23]. We discussed new forms of student's activity related to data analysis introduced by academics and practitioners: building art objects and storytelling based on data; shared data collection by citizens through mobile devices, "play with data" modern data visualization services [11]. In our opinion, Twitter is a powerful tool for creating these new activities and overcoming the barriers that arise during studying quantitative methods.

Analysis of scientific works [1; 2; 7] shows that if we want to use Twitter in university research and teaching every student need to take the following steps.

1. Set up their own Twitter account.
2. Start following other users.
3. Learn useful Twitter terminology (followers, following, unfollow, block, retweet, reply, first part of every twitter user name, mentions, hashtag, direct message, shortened URLs etc.)
4. Understand Tweeting styles.

Twitter researchers from LSE Public Policy Group identify three styles of tweets [7]. Substantive tweets are written in full sentences, are easy to understand, and the author is usually famous. They follow a formal or corporate style and are used by formal organizations, news outlets etc. Tweets written in this style can be used to educate students. Conversational style is more informal, the content of tweets can cover

personal and professional interests, it is suitable for younger scientists and teachers. The compromise style takes everything best from substantive and conversational, is suitable for small groups, departments, research groups. In our view, the scientists have successfully described the characteristics of the styles, their advantages and disadvantages in Table 1 [7].

Table 1. Features Twitting styles [7, p. 5]

Features	Pros	Cons
<i>Substantive style</i>		
<ul style="list-style-type: none"> – Tweet is always in full sentences – Few abbreviations are used, except for shortened URLs – Must be independently understandable – Normally each tweet is the headline or ‘taster’ for a blog, post, web article or other longer piece of text – Focus is consistent and solely professional or single topic – The team producing tweets often remains invisible 	<ul style="list-style-type: none"> – Always make sense to all readers – Especially accessible when viewed in a combined stream of many tweets from different authors – Attracts well-defined interests 	<ul style="list-style-type: none"> – No conversational element, so can appear corporate and impersonal – Hence may turn off some potential followers – Takes a professional skill to always write crisply and substantively
<i>Conversational style</i>		
<ul style="list-style-type: none"> – Most or many tweets are fragments from an ongoing conversation with followers or thoughts from many different aspects of tweeter’s experiences – Content is eclectic, drawing on professional interests but also on personal life, commenting on current events, etc. and so covers diverse topics – Includes author photograph 	<ul style="list-style-type: none"> – Conveys personality well for individuals, or organizational culture for collective accounts – Attracts people who like this personality or culture – Good at building ‘community’ and strengthening followers’ identification with site 	<ul style="list-style-type: none"> – Some tweets only make sense to those who are involved in their conversation – Very hard to follow in a Twitter feed from many different authors – With eclectic contents many followers may not value many of the tweets – Hence incentives for some folk to unfollow over time
<i>Middle ground style</i>		
<ul style="list-style-type: none"> – Most tweets are substantive as above but some are short and conversational – Goes beyond a ‘corporate’ focus without being too eclectic – Uses retweets to diversify/liven up the tweet stream – Uses team photos, and the blog site or website identifies team members well 	<ul style="list-style-type: none"> – Injects more personality or organizational culture into a basically professional approach – Most tweets are independently understandable 	<ul style="list-style-type: none"> – Some conversational tweets will not make sense when read in combined tweet streams

Mark Ferris and Sherri Cheng [2] explored how Twitter could be used in the introductory statistics course. Scientists identified principles for learning statistics that

are applicable to evaluating the efficacy of Twitter usage in such statistics class. Some of the principles are listed here:

- Students learn by constructing knowledge and active involvement in learning activities.
- Students learn to do well only what they practice.
- Technological tools should be used to help students visualize data.
- Students learn better if they receive helpful feedback.

In their course teachers suggested students to follow the more popular Twitter accounts: The Wall Street Journal, The Economist, The New York Times, The Guardian, Nature, Five Thirty Eight, Hans Rosling, Pew Research because these accounts offer real and sound data and statistics related topics on a frequent basis.

Scientists gave a series of weekly assignments on Twitter: students needed to find and retweet 6 statistical tweets in various assigned categories, identify 10 new statistical producing entities to follow, and build their individual Twitter “channel.” Also, in final of course they chose one tweet and write two sentences summarizing the tweet; two sentences analyzing the credibility and biases of the article and its sources; propose two thoughtful questions about the article.

Note that the R programming environment has the appropriate package “The fivethirtyeight R”, which facilitates the use of Twitter resources FiveThirtyEight in data science courses [4].

We added some tweeters to the recommendation list, including Ukrainian resources as well as resources related to population censuses. A fragment of comparative table with statistics for these twitter accounts is given below (Table 2).

Table 2. Twitters for using in the data analysis courses

Tweeter name	Content	Follow	Followed
FiveThirtyEight	Statistician N. Silver: politics, economics, science, life and sports.	288	1,1M
HansRosling	Remember Hans Rosling. Data and visualizations with Gapminder created Hans Rosling	170	350,2K
Pew Research	Pew Research Center. Public-opinion polling, demographic research, content analysis and other data-driven social science research.	94	404,6K
GFK	Data and science as a leading global market intelligence company for the tech and durable goods industry	3056	18,8K
VOX Ukraine	VOX Ukraine	581	6703
TEXTY.Org.Ua	Official Twitter account of the TEXTY site	972	4013
Stop Faking News	Stop Faking News of Mohyla School of Journalism	638	30,8K
IOM – UN Migration	Official Account of IOM	3442	119,1K
U.S. Census Bureau	USA Census Bureau	916	98,3K

The Impact of Social Sciences is a project (by the London School of Economics and Political Science, Imperial College London, and the University of Leeds) that aims to investigate the impact of academic work in the social sciences on government and

policymaking, business and civil society [25]. In this project scientists compiled lists of academics on Twitter and curated it since 2011. The lists cover social sciences, humanities and arts, STEM subjects, media and journalism, higher education resources. We have compiled a comparison table and the bar plot with statistics for these Twitter lists in October, 2019 (Table 3, Figure 3).

Analysis of Table 3 and Figure 3 shows that Soc Sci Academic Tweeters are the most representative.

Table 3. Academic lists in Twitter

List name	Content	Members	Subscribers
HE Academic Tweeters	Higher education and educational technology	99	491
Media Academic Twitters	Media projects	60	313
Soc Sci Academic Tweeters	Anthropology, economics, geography, law, political science and sociology	305	1287
Art academic Tweeters	Art, history, languages, literature, philosophy, music	176	598

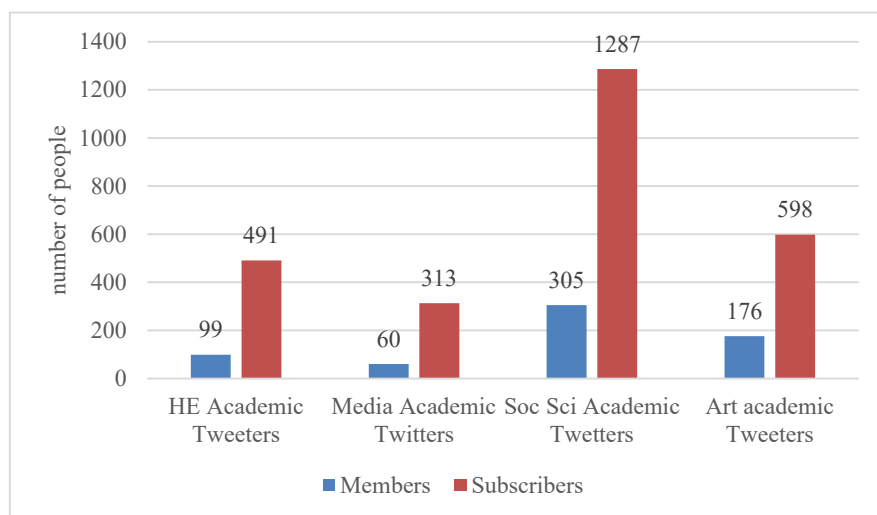


Fig. 3. Academic lists in Twitter: members and subscribes

We can collect tweets using different R packages. An analysis of the capabilities of the twitterR package showed that it has a large set of functions for analyzing Twitter data:

- Sending a Twitter DM after completion of a task
- Viewing Twitter timelines
- Retrieving the most recent tweet ID from a database
- Saving the tweets found to a database
- Viewing Twitter trends
- Setting up a database backend for twitterR

- Class “directMessage”: A class to represent Twitter Direct Messages
- Management of Twitter users
- Converting twitterR lists to data or charts
- Getting the favorite tweets
- Retrieving current rate limit information
- Setting up the OAuth credentials for a twitterR session
- Detailing relationship between yourself & other users
- Removal of retweets
- Searching Twitter
- Importing twitterR objects from various sources
- Manipulating Twitter status
- Loading twitterR data to a database
- Manipulating Twitter direct messages
- Return of statuses
- A container object to model Twitter users
- Decoding shortened URLs
- Class to contain a Twitter status
- Registering OAuth credentials to twitter R session
- Setting up the OAuth credentials for a twitterR session from an existing Token object.

Another new R package that deserves attention in the context of training sociologists is *saotd* package. It is focused on utilizing Twitter data (cran.r-project.org/web/packages/saotd/vignettes/saotd.htm). Authors of this package says that collecting data and analyzing it for sentiment can provide a powerful tool for the organization to better understand their target population. This package allows users to acquire data from tweets using the Public Twitter Application Programming Interface. The package is broken down into five different phases: 1) acquirement; 2) research; 3) topic analysis; 4) sentiment calculation; 5) visualization.

We can use different types of analysis for the collected data. Content analysis allows to define the most popular topics. Sentiment analysis helps define what opinions, views and emotions users have about the subject. Network analysis shows who is connected with whom. Geospatial analysis presents where users or tweets come from.

We propose such student’s activities using Twitter.

- Create a table explaining the basic concepts of tweeter (followers, following, unfollow, block, retweet, reply, hashtag, direct message, shortened URLs).
- Suggest two examples illustrating different styles of tweeting.
- Compare Tweeter accounts of the presidents Zelensky and Trump [17]. (Note that at the time of article writing, President Zelensky did not follow anyone on Twitter).
- Write a report about Ukrainian government organizations on Twitter [3].
- Find relevant accounts of organizations related to Census 2020 and follow them.
- Create infographics about Twitter world statistics and Ukrainian Twitter statistics [5].
- Tell a story about fake news checking with the help of the Twitter Stop Fake of Mohyla School of Journalism.
- Discuss ethical framework for publishing Twitter data in social research [24].

- Take part in the survey the future of immigration in Europe and some potential migration scenarios; find twitter feeds of Ukrainian migrants in Poland.
- Find relevant accounts of famous Ukrainian social scientists and compile a list.

3 Conclusions and perspectives of further research

Twitter is one of the popular social media in the world. Presidents of many countries as well as political parties, parliaments, research agencies, scientists, teachers use Twitter. Twitter allows to study the behavior and attitudes of people, to understand more deeply those who they follow, contributes to democratization and transparency, helps to develop innovation, systemic and critical thinking, data literacy.

An important point in using Twitter in educational course is to select popular and relevant Twitter accounts that students can follow. We offer our students to follow such Twitter accounts: The Guardian, Five Thirty Eight, Hans Rosling, Pew Research, VoxUkraine, TEXTY.Org.Ua, Rob J Hyndman, GFK, AmstatNews (American Statistical Association), RoyalStatSoc (Royal Statistical Society), UN Migration, U.S. Census Bureau and other.

The main criteria for choosing are: this accounts give real and sound data and links to access the relative research; the list includes organizations, research agencies, well-known statisticians and sociologists; the list includes international organizations, national research centers, Ukrainian organization resources; the list should be considered as the starting point from which the student will build and develop his channel.

You can highlight such students activities using Twitter: register a new account for the course, find relevant accounts of organizations related to social statistics and demographics and follow them; find relevant accounts of famous personalities in this area, find and retweet tweets corresponding to the current topic of the course; write an essay based on one of the found tweets; evaluate and analyze classmates' tweets; create your own list of recommended twitters for a specific topic or field of knowledge; create infographics of global Twitter statistics and Ukrainian Twitter statistics; create data visualization on a basic Twitter data; discuss twitting styles, check fake news and other.

Further development of work in this direction is the creation of teaching and methodological support for using Twitter in Social Statistics and Demographics course in Ukrainian universities.

References

1. Dhir, A., Buragga, K., Boreqqah, A.A.: Tweepers on Campus: Twitter a Learning Tool in Classroom? *Journal of Universal Computer Science* **19**(5), 672–691 (2013)
2. Ferris, M., Cheng, S.: Using Twitter to Energize the Introductory Statistics Class. *Technology Innovations in Statistics Education* **11**(1) (2018). <https://escholarship.org/uc/item/6207w80h>
3. Hordiienko, T.: Koho pochyty u Titteri: piat kumednykh akauntiv vid ukrainskykh derzhystanov (Whom to read from Twitter: Five Crazy Accounts View of Ukrainian State

- Institutions).
https://ms.detector.media/web/social/kogo_pochitati_u_twitteri_pyat_kumednikh_akauntiv_vid_ukrainskikh_derzhustanov (2018). Accessed 25 Oct 2019
4. Kim, A.Y., Ismay, C., Chunn, J.: The fivethirtyeight R Package: “Tame Data” Principles for Introductory Statistics and Data Science Courses. *Technology Innovations in Statistics Education* **11**(1). <https://escholarship.org/uc/item/0rx1231m> (2018). Accessed 21 Mar 2019
 5. Lin, Y.: 10 Twitter Statistics Every Marketer Should Know in 2020 [Infographic]. <https://www.oberlo.com/blog/twitter-statistics> (2019). Accessed 21 Mar 2020
 6. McCormick, T.H., Lee, H., Cesare, N., Shojaie, A., Spiro, E.S.: Using Twitter for Demographic and Social Science Research: Tools for Data Collection and Processing. *Sociological Methods & Research* **46**(3), 390–421 (2017). doi:10.1177/0049124115605339
 7. Mollett, A., Moran, D., Dunleavy, P.: Using Twitter in university research, teaching and impact activities. A guide for academics and researchers. LSE Public Policy Group. https://blogs.lse.ac.uk/impactofsocialsciences/files/2011/11/Published-Twitter_Guide_Sept_2011.pdf (2011). Accessed 25 Oct 2019
 8. Murthy, D.: Towards a Sociological Understanding of Social Media: Theorizing Twitter. *Sociology* **46**(6), 1059–1073 (2012). doi:10.1177/0038038511422553
 9. Panchenko, L., Chomiak, A.: Cloud technologies for training future sociologists of visualizing data of social and demographic statistics. *Transactions Georgian Technical University. Automated Control Systems* **2**(26), 153–156 (2018)
 10. Panchenko, L., Khomiak, A.: Education Statistics: Looking for a Case-study for Modelling. CEUR-WS.org, online (2020, in press)
 11. Panchenko, L.F.: Hramotnist v haluzi danykh: vyznachennia pidkhody, napriamky formuvannia (Data Literacy: Definitions, Approaches, Formation Directions). *Visnyk Natsionalnoho tekhnichnoho universytetu Ukrainy “Kyivskiy politekhnichnyi instytut”*. *Politolohiia. Sotsiolohiia. Pravo* **3**(43), 118–127 (2019)
 12. Panchenko, L.F.: Methodology of Using Structural Equation Modeling in Educational Research. In: Ermolayev, V., Mallet, F., Yakovyna, V., Kharchenko, V., Kobets, V., Kornilowicz, A., Kravtsov, H., Nikitchenko, M., Semerikov, S., Spivakovsky, A. (eds.) *Proceedings of the 15th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer (ICTERI, 2019), Kherson, Ukraine, June 12-15 2019, vol. II: Workshops*. CEUR Workshop Proceedings **2393**, 895–904. http://ceur-ws.org/Vol-2393/paper_411.pdf (2019). Accessed 30 Jun 2019
 13. Panchenko, L.F.: Training Sociology Students in Computer Analysis of Demographic Processes and Structure. *Information Technologies and Learning Tools* **65**(3), 166–183 (2018). doi:10.33407/itlt.v65i3.2034
 14. Shyshkina, M.P., Marienko, M.V.: The use of the cloud services to support the math teachers training. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019), Kryvyi Rih, Ukraine, December 20, 2019*, CEUR-WS.org, online (2020, in press)
 15. Siemens, G.: Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology & Distance Learning* **2**(1) (2005). http://www.itdl.org/Journal/Jan_05/article01.htm. Accessed 25 Oct 2019
 16. Social Media Stats Ukraine | StatCounter Global Stats. <https://gs.statcounter.com/social-media-stats/all/ukraine> (2020). Accessed 10 Jul 2020
 17. Spannbaauer, A., Chunn, J.: Trump Twitter analysis using the tidyverse. https://fivethirtyeight-r.netlify.com/articles/trump_twitter.html (2020). Accessed 10 Jul 2020

18. Velychko, V.Ye., Fedorenko, E.H., Kassim, D.A.: Conceptual Bases of Use of Free Software in the Professional Training of Pre-Service Teacher of Mathematics, Physics and Computer Science. In: Kiv, A.E., Soloviev, V.N. (eds.) *Proceedings of the 1st International Workshop on Augmented Reality in Education (AREdu 2018)*, Kryvyi Rih, Ukraine, October 2, 2018. *CEUR Workshop Proceedings* **2257**, 93–102. <http://ceur-ws.org/Vol-2257/paper11.pdf> (2018). Accessed 30 Nov 2018
19. Vlasenko, K., Chumak, O., Lovianova, I., Kovalenko, D., Volkova, N.: Methodical requirements for training materials of on-line courses on the platform “Higher school mathematics teacher”. In: Semerikov, S., Chukharev, S., Sakhno, S., Striuk, A., Osadchyi, V., Solovieva, V., Vakaliuk, T., Nechypurenko, P., Bondarenko, O., Danylchuk, H. (eds.) *The International Conference on Sustainable Futures: Environmental, Technological, Social and Economic Matters (ICSF 2020)*. Kryvyi Rih, Ukraine, May 20-22, 2020. *E3S Web of Conferences* **166**, 10011 (2020). doi:10.1051/e3sconf/202016610011
20. Vlasenko, K., Kovalenko, D., Chumak, O., Lovianova, I., Volkov, S.: Minimalism in Designing User Interface of the Online Platform “Higher School Mathematics Teacher”. *CEUR-WS.org*, online (2020, in press)
21. Vlasenko, K., Lovianova, I., Sitak, I., Chumak, O., Kondratyeva, O.: Training of Mathematical Disciplines Teachers for Higher Educational Institutions as a Contemporary Problem. *Universal Journal of Educational Research* **7**(9), 1892–1900 (2019)
22. Vlasenko, K., Volkov, S., Sitak, I., Lovianova, I., Bobyliev, D.: Usability analysis of on-line educational courses on the platform “Higher school mathematics teacher”. In: Semerikov, S., Chukharev, S., Sakhno, S., Striuk, A., Osadchyi, V., Solovieva, V., Vakaliuk, T., Nechypurenko, P., Bondarenko, O., Danylchuk, H. (eds.) *The International Conference on Sustainable Futures: Environmental, Technological, Social and Economic Matters (ICSF 2020)*. Kryvyi Rih, Ukraine, May 20-22, 2020. *E3S Web of Conferences* **166**, 10012 (2020). doi:10.1051/e3sconf/202016610012
23. Vlasenko, K.V., Volkov, S.V., Kovalenko, D.A., Sitak, I.V., Chumak, O.O., Kostikov, A.A.: Web-based online course training higher school mathematics teachers. In: Kiv, A.E., Shyshkina, M.P. (eds.) *Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019)*, Kryvyi Rih, Ukraine, December 20, 2019, *CEUR-WS.org*, online (2020, in press)
24. Williams, M.L., Burnap, P., Sloan, L.: Towards an Ethical Framework for Publishing Twitter Data in Social Research: Taking into Account Users' Views, Online Context and Algorithmic Estimation. *Sociology* **51**(6), 1149–1168 (2017). doi:10.1177/0038038517708140
25. Your favourite academic tweeters: lists available to browse by subject area. <https://blogs.lse.ac.uk/impactofsocialsciences/2011/09/02/academic-tweeters-your-suggestions-in-full> (2011). Accessed 17 Aug 2015