Statistical Literacy and Education in the State Statistical Office of the Republic of Macedonia

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Abstract

In modern knowledge-driven society, the knowing how to use statistical information is a necessary skill to citizens. The State Statistical Office of the Republic of Macedonia recognizes the importance of the proper use of statistical data. According to its Strategy, the State Statistical Office will work on improving statistical literacy, and the specific sub-program: Improving statistical literacy is defined.

This paper will describe the actions taken by the State Statistical Office to promote the statistical culture in the country. In addition, a description will be given of the unique postgraduate studies in "Statistical Methods for Business and Economics".[2]

Keywords

Postgraduate studies, statistical literacy, SSO strategy

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INTRODUCTION

The use of statistical information became a crucial need for citizens in their professional and private activities and it is of essential importance for their active participation in the society. The complexity of the world where we live shows that it is almost impossible to comment some economic or social event without the use of statistics.

In the last decade, the statistical knowledge was concentrated only to specialized groups (like researchers), who were the most frequent users of statistics; nowadays, its use is widely present in everyday life. However, the lack of knowledge in statistics, including its interpretation and use of statistical information is still existent.

Statistical Offices are responsible not only for producing, disseminating and analyzing statistical information, but also for ensuring that this information is well understood by the users. This paper outlines the activities taken by the State Statistical Office to improve statistical literacy since 2007.

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1 WHAT IS STATISTICAL LITERACY

There are several approaches concerning the meaning of statistical literacy.

Statistical literacy, as a concept, includes the ability to read and interpret statistical data in daily and other media (newspapers, Internet, television channels, etc.) and includes the same data shown through, for example, graphs, tables, statements, statistical surveys and studies (UNECE, 2012).

Statistical literacy is the ability to understand and use statistics and it includes different skills linked together, such as:

- ability to understand/interpret statistical information,
- ability to use statistical information,
- ability to be critical towards statistical information,
- ability to communicate making use of statistical information (Ribeiro, 2013).

2 LEGAL AND STRATEGIC FRAMEWORKS OF STATISTICAL LITERACY IN THE REPUBLIC OF MACEDONIA

The Law on State Statistics regulates official statistics in the Republic of Macedonia. In Article 8, the promotion of statistical literacy is stated as one of the main duties of the State Statistical Office.

The empowerment of the main duty of the State Statistical Office is included in the Strategy of the State Statistical Office. The mission of the SSO states: The State Statistical Office produces and disseminates official statistical data on the Macedonian economy and society as a basis for the process of decision making based on relevant information.

For the period 2017–2019, several priorities are defined for implementation of statistical objectives. One of them is "Strengthening the cooperation and communication with users". Under this priority, several objectives are defined:

- simplifying the access to statistical data,
- modernizing the manner of disseminating statistical data,
- increasing the amount of published data and providing data with longer time series,
- measuring user satisfaction.

In order to facilitate the access to statistical data, different dissemination products are developed and statistical users are provided with tools to decipher the specific language of statistics.

3 STATISTICS IN PRIMARY AND SECONDARY SCHOOLS

Integrating statistical concepts and reasoning from primary school through to secondary school should develop a nation of critical thinkers and capable consumers of information that would ultimately benefit social progress – future government and business leaders.

Statistical literacy is more than numeracy. It includes the ability to read and communicate the meaning of data. This quality makes people literate as opposed to just numerate. The weakness in quantitative skills is summarized under the term statistical innumeracy. In particular, among the younger generations there is an increasing need to understand quantitative data and facts.

The process of developing statistical reasoning must involve both students and teachers. For students, it is essential to build capabilities when they supplement what they have heard and read on statistics and to actually produce statistics. For teachers, it is of crucial importance to have not only theoretical background in statistics, but also to be able to interpret statistical information. Therefore, statistical organizations must involve teacher educators and address the professional development of teachers.

In the Republic of Macedonia, children start to learn the basic elements of statistics in the upper grades of primary schools in the syllabus for geography and mathematics. Elementary topics such as the gathering and organization of data, measures of central tendency and basic probability calculation are

taught at primary and secondary schools in the subject mathematics. The reading and interpretation of official statistical data is included in lectures of geography.

The State Statistical Office cannot be satisfied with this situation and actions for change must be undertaken. The institution must put efforts to influence the importance of continuity of learning and building statistical skills and knowledge progressively, rather than learning concepts in isolation and out of real-world context. There is a need to design a curriculum on statistics for primary and secondary schools, which provides a rich and diverse means of incorporating the authentic and contextual teaching of statistical concepts.

In order to improve statistical literacy, several activities were organized in the past years. So, in 2016, a caravan for "Statistical Lectures" was organized in two rounds in secondary schools, with visits to four gymnasiums in Skopje and two secondary schools of economics in Skopje in the first round, and visits to 8 secondary schools/gymnasiums around the country. Around 50-60 pupils visited each lecture on statistics. Each year, groups of pupils from the secondary schools of economics in Bitola and Skopje visit the SSO.

4 UNIVERSITY-LEVEL EDUCATION IN STATISTICS

At university level, statistics is an element of different studies. In the last decade, the reform of tertiary education in the country was marked with the European Credit Transfer and Accumulation System (ECTS) and introduction of the Bologna Process, which means statistics to be part in minor fields of study.

Young people, in particular, must be helped to overcome their reluctance to deal with this subject and become critical and responsible users of statistics. The co-operation with educational institutions is an important issue for the development of the statistical system, both for reinforcement of the technical capacity for the production of official statistics and for the promotion of statistical literacy.

In the last decade, the Macedonian tertiary educational system was rapidly changed and one of the big changes was the foundation of many new state and private universities. In accordance with the Law on Higher Education, in the Republic of Macedonia, there are 20 higher education institutions of which 16 are universities. There are 6 state universities.

In order to obtain information about studying statistics in tertiary education, a short questionnaire was sent to all universities and faculties. The main point of the study was to get information about syllabus on statistics. In the survey were included 138 faculties and higher educational organisations. On the basis of the results gained from 69 faculties, statistics as a subject is taught at: Faculties of Economics, Faculties of IT and Computer Sciences, Faculties of Medicine/Veterinary Sciences.

At most of the faculties, statistics is taught in the third/fourth semester or in the sixth/seventh semester.

Table 1 Students enrolled in undergraduate studies at higher vocational

	Mode of study	Total		
		Total	Male	Females
TOTAL	total	56 941	25 272	31 669
	full-time	50 701	22 543	28 158
PUBLIC FACULTIES	total	48 087	20 141	27 946
	full-time	43 440	18 343	25 097
Faculty of Natural Sciences and Mathematics, Skopje	total	1 209	377	832
	full-time	1 161	359	802
Theoretical mathematics	total	23	9	14
	full-time	22	8	14

Table 1 (continuation)

	Mode of study	Total		
		Total	Male	Females
Mathematics - informatics applied	total	4	2	2
	full-time	4	2	2
Faculty of Computer Science and Engineering - Skopje	total	52	40	12
	full-time	52	40	12
State University of Tetovo, Faculty of Natural Sciences and Mathematics	total	1 003	383	620
	full-time	991	379	612
Faculty of Mechanical Engineering, Skopje	total	1 156	758	398
	full-time	1 156	758	398
Faculty of Technology and Metallurgy, Skopje	total	202	66	136
	full-time	202	66	136
Faculty of Agricultural Sciences and Food, Skopje	total	41	23	18
	full-time	37	21	16
Faculty of Computer Science and Engineering, Skopje	total	3 005	1 997	1 008
	full-time	3 005	1 997	1 008
Faculty of Technical Engineering, Bitola	total	544	361	183
	full-time	513	334	179
Faculty of Biotechnical Sciences - Bitola	total	153	70	83
	full-time	134	54	80
Faculty of Information and Communication Technologies, Bitola	total	546	378	168
	full-time	544	377	167
Faculty of Informatics, Shtip	total	406	274	132
	full-time	354	235	119
Faculty of Agriculture, Shtip	total	11	8	3
	full-time	7	6	1
Faculty of Electrical Engineering, Radovish	total	168	132	36
	full-time	122	89	33
University of Information Science and Technology - Ohrid, Faculty of Computer Science and Engineering	total	151	111	40
		151	111	40
University of Information Science and Technology - Ohrid, Faculty of Computer Networks and Security	total	56	42	14
	full-time	56	42	14
University of Information Science and Technology - Ohrid, Faculty of Information Systems, Visualisation, Multimedia and Animation	total	77	47	30
	full-time	77	47	30
University of Information Science and Technology - Ohrid, Faculty of Information and Communication Sciences	total	22	12	10
	full-time	22	12	10
Faculty of Applied Sciences, State University of Tetovo	total	473	347	126
	full-time	473	347	126

Table 1 (continuation)

	Mode of study	Total		
		Total	Male	Females
Faculty of Food Technology and Food, State University of Tetovo	total	98	64	34
	full-time	98	64	34
Faculty of Medicine, Skopje	total	2 587	685	1 902
	full-time	2 366	636	1 730
Faculty of Dentistry, Skopje	total	606	182	424
	full-time	606	182	424
Faculty of Medicine - State University, Tetovo	total	1 462	492	970
	full-time	1 268	449	819
Faculty of Technology and Metallurgy, Skopje	total	227	62	165
	full-time	227	62	165
Faculty of Veterinary Medicine - Skopje	total	136	65	71
	full-time	136	65	71
Faculty of Economics, Skopje	total	3 547	1 351	2 196
	full-time	3 179	1 185	1 994
Faculty of Philosophy, Skopje	total	2 254	566	1 688
	full-time	1 925	471	1 454
Faculty of Pedagogy, Skopje	total	873	151	722
	full-time	675	121	554
Faculty of Pedagogy, Bitola	total	134	21	113
	full-time	110	17	93
Faculty of Economics, Prilep	total	754	300	454
	full-time	731	288	443
Faculty of Economics, Shtip	total	769	271	498
	full-time	604	220	384
Faculty of Applied Sciences - State University of Tetovo	total	5	3	2
	full-time	5	3	2
Faculty of Economics - State University of Tetovo	total	468	249	219
		433	229	204
Faculty of Business Administration - State University of Tetovo	total	329	174	155
		329	174	155
PRIVATE HIGHER VOCATIONAL SCHOOLS	total	234	154	80
	full-time	123	79	44
Business Academy Smilevski, Skopje	total	234	154	80
	full-time	123	79	44
International Slavic University "G.R. Derzhavin" - Faculty of Information Technology	total	36	33	3
		20	17	3

Table 1 (continuation)

	Mode of study	Total		
		Total	Male	Females
International Balkan University - Faculty of Engineering	total	356	263	93
	full-time	356	263	93
SEE - Faculty of Business and Economics	total	469	228	241
	full-time	412	192	220
SEE - Faculty of Public Administration and Political Sciences	total	362	247	115
	full-time	286	196	90
International Balkan University - Faculty of Humanities and Social Sciences	total	200	88	112
	full-time	200	88	112
International Slavic University "G.R. Derzhavin" - Faculty of Economics and Organisation of Enterprises	total	86	55	31
	full-time	41	26	15
International Slavic University "G.R. Derzhavin" - Faculty of Psychology	total	81	18	63
	full-time	62	12	50
International Slavic University "G.R. Derzhavin" - Faculty of Safety Engineering	total	78	61	17
		41	33	8

Source: State Statistical Office of Macedonia

Studies on statistics can be divided in three classes: descriptive statistics, probability statistics and sampling and biostatistics, and correspond with the following faculties: Faculty of Economics, Public Administration, Faculty of ICT and Computer Sciences and Faculty of Medicine/Veterinary Sciences. Only two respondents mentioned that in addition to the theoretical lectures, students also learn specific software: R-software and Libri.

The students of the Faculty of Medicine learn so-called biostatistics, which cover descriptive statistics and vital and demographic statistics with practical examples.

Faculties where statistics is taught as probability statistics include lectures on analysis of time series, too.

Very often, the classes with descriptive statistics include lectures on the basics of official statistics, such as data collection, data tabulation and interpretation of statistical tables.

The State Statistical Office is willing to improve this situation and Memoranda of co-operation with public and private universities were signed in the last years.

Furthermore, statisticians gave lectures on different topics of official statistics to students in the premises of the SSO or in the premises of faculties.

5 POSTGRADUATE STUDIES IN STATISTICAL METHODS FOR BUSINESS AND ECONOMICS

Under the TEMPUS program, the consortium composed of the Faculty of Economics at the University "Ss Cyril and Methodius", University Roma III, Rome Italy, University Carlos III, Madrid Spain and the State Statistical Office of the Republic of Macedonia launched postgraduate studies in statistical methods for business and economics, in the academic year 2007/2008. The studies were organized in the premises of the Faculty of Economics where, for the needs of the studies, special laboratories and a library with relevant books were equipped. The lectures were given in English language by professors from the Universities, participants in the Project, and statistical data for the work of students were provided by the State Statistical Office.

The studies were organized in three semesters (plus one semester for preparation of master's thesis) and the following exams were included:

- Multivariate statistical methods,
- Theoretical econometrics,
- Mathematical statistics,
- Computational statistics,
- Simulation methods,
- Advanced econometrics,
- Time series analysis,
- Statistical quality control,
- Econometrics for finance.

During the studies, the students gained theoretical knowledge in different subjects for economic and statistical analysis as well skills to work in several software packages: E-View, R-software, SAS software, MATLAB and Statistics for quality.

After the end of the TEMPUS project, the postgraduate studies were embedded in the regular Program for postgraduate studies at the Faculty of Economics in Skopje. Up to 2017, 35 students finished these studies and 9 students graduated in 2009 during the lifetime of the Project.

These studies are unique for several reasons:

- for the first time in the country studies are organized which offer comprehensive knowledge for quantitative economic research,
- the students gained solid theoretical knowledge of economic analysis, skills to use different software and analytical skills for proper use and interpretation of statistical data in daily work,
- the State Statistical Office and other organizations associated with statistics (ministries, central bank, research institutes, consultants, etc.) could recruit qualified staff for statistics from the labor market.

6 TRAINING PROGRAMS FOR EMPLOYEES IN OFFICIAL STATISTICS

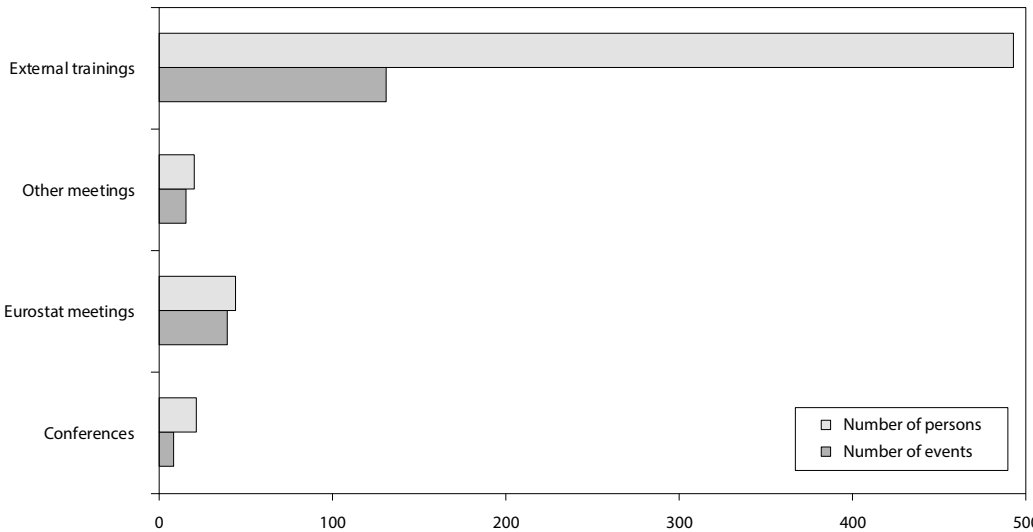
The State Statistical Office of the Republic of Macedonia was one of the first state institutions that started the process for joining the European standards after proclaiming state independence in 1991. The first contacts with the international community were established in 1993. The management of the SSO has recognized that for the production of high-quality data on the Macedonian economy and society in accordance with European standards, it is necessary for the staff to have an adequate level of statistical knowledge.

In this context, the attendance at TES/ESTP courses was very beneficial for young and middle-level staff for training in methodologies, statistical production and statistical-mathematical methods.

In the last three years, more than 254 persons attended 20 EMOS Webinars on different topics.

The area that requires special attention in the statistical organizations is the development of knowledge transfer models. Bearing in mind that it is not possible for all employees to receive the same quantity of required knowledge, it is necessary that the institutions develop systems for exchange of experiences, within the institution, between certain numbers of persons who have similar professional engagements. The State Statistical Office noticed the benefits of this model and five years ago introduced the in-house training courses. The staff that attended training in statistical methodologies organized training for their colleagues. In addition, many colleagues gave informative lectures on different topics (like introduction of ESA 2010, metadata, PC AXIS, quality issues) to inform staff about the content, importance and influence of novelties in the daily work of the institution. The relevance of the topic for daily work was one criteria for selection of training persons. Also, this training was used before start up some new activitiy. For example, before introducing PC AXIS software for WEB publishing, SSO experts on PC AXIS have organised trainings for all statisticians. These trainings were organised as Workshops with duration

Figure 1 Participation of SSO staff on different kinds of trainings, 2017



Source: State Statistical Office of Macedonia

of 2 days, where statisticians gained information how to use PC AXIS, practical work with data tables and tutorial for PC AXIS which is available on SSO INTRANET site. Trinings on topics like metadata, quality, writing Press releases, were intended for young statisticians and they lasted a couple of hours. All these trainings are organised within SSO premises-classroms, equipped with computers, projectors and other relevant euipment.

7 STATISTICAL LITERACY AS AN ASPECT OF MEDIA LITERACY

The media have a versatile role related to national statistical institutes. First, the media are interested in the activities of NSIs as public organizations. Second, the media are important redistributors of statistical information. Third, the media are large-scale users of statistical information – NSIs output is a raw material, i.e. input to media production processes and activities. Statisticians are well aware of how the media can sometimes misinterpret statistical data (UNECE, 2008). Numerous misunderstandings and misinterpretations of statistical data can be observed in media reports, in daily newspaper articles and in direct contact with the users (UNECE, 2012).

Indeed, to understand the meaning of a text, journalists need to be able to do more than the reading of statistical information; they need to understand the concepts and methodologies used in its preparation. NSIs must improve statistical thinking and train journalists how to "read" the data. An important objective to all statistical agencies should be to promote statistical literacy of the media workers (UNECE, 2008).

The State Statistical Office has a long tradition in the communication with media. In the past, journalists were one of the regular user groups and the co-operation was twofold: journalists informed about the data and activities in the SSO and SSO staff assisted in proper interpretation of data. Many journalists confirmed that when they had no idea for the day, they came to the SSO library and the article was finished in an hour. Besides, the SSO regularly organized info sessions for journalists before crucial methodological changes or before conducting Censuses.

However, the digitalization and appearance of social media has changed completely the media sector in the country. The number of newspapers and informative radio and TV stations has decreased dramatically in the last years.

These changes refer to "consumption" of statistics by journalists. The SSO is aware of this situation and several actions are undertaken:

- improving the visualization of the SSO web site with infographics on specific topics,
- strengthening the co-operation with different information agencies,
- strengthening the co-operation with Faculties/Studies of Journalism and informing the future journalists about statistics,
- active participation of the SSO in different social media.

CONCLUSIONS

The main message of statistical offices: their reliability based on quality data and transparent methods should be conveyed through an effective communication strategy thus building a specific brand. The SSO should resort to measures to increase statistical literacy and by being transparent. This is of strategic importance for increasing the appreciation of official statistics, leading users to perceive the statistical office as trustworthy.

Effective user engagement should be a continuous dialogue, not just a series of one-off consultations.

Besides traditional areas, there are emerging needs that need to be illuminated by statistics. In this sense, the presence in social media cannot be limited only to posting statistical data on own social media platform. The SSO needs to make an extensive analysis of what is being said about them in social media and react when needed. It is necessary to respond to what is being said in the different platforms, show that they are listening and handle important issues in the platforms where the users are active, i.e. by going to their meeting place. SSO responsible staff must talk with the network and spread the statistical office brand.

The SSO must develop a strategy how to generate awareness and interest in national statistics and their practical application to everyday life. The actions to increase the statistical literacy in education should be the starting points for improving statistical literacy.

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