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The Effect of Statistical Literacy on Response to Environmental Change

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Background and Purpose: Due to constant social, technological and economic change, social actor, interacting with environment, is constantly faced with the need to acquire new knowledge and develop different competences – field of statistics included. The latter, with development of statistical literacy, enables one to reflectively analyse environment and respond to its changes. The aim of this paper is to determine response effectiveness of a better statistically literate social actor to environmental changes from perspective of different generations in Slovenia.
Design/Methodology/Approach: Empirical data was collected through a survey questionnaire, processed and analysed using chosen descriptive and inferential statistical methods. 1239 respondents of all three Slovenian generations participated. Two research questions were asked, one relating to the whole sample and the other to three subsamples according to age groups and generations.
Results: Based on whole sample of all three generations, it can be concluded that statistical literacy influences responsiveness of social actor to environmental changes. Survey results show that better statistically literate social actors are more completely and actively involved in working environment, personal and social life and respond to environmental changes more effectively.
Conclusion: More attention, on urgency to develop statistical literacy individually in professional and everyday life, should be put on raising awareness of statistical knowledge importance to cope with environmental changes and improving supply and accessibility of formal and informal forms of statistical education for all generations.
Research results will also contribute to better planning and implementation of statistics education at the level of educational institutions and teachers of all three generations.

Keywords: *environmental change, statistics, statistical literacy, social actor, education, generations*

1 Introduction

Change is the only constant of social and technological development. Turbulent environment we live in requires constant change, both on an individual level - social actor, generation and social level as a whole. Dynamics of social change require rapid responsiveness of social actor, who empowered with statistical knowledge and competence, should respond to social, economic and technological development. In knowledge society highly qualified experts - including those with statistical knowledge, will have to proactively enter lifelong learning and statistics education »throughout their lives« and »for all life dimensions«; so they could appropriately statistically literate be able to face current social changes more effectively.

Appropriate statistical knowledge is also relevant to managers in decision-making in production and economic systems, conditioned by implementation of innovation projects, economic and mathematical models and methods of process management based on mathematical apparatus and statistical data (Mylnikov, 2016). Use of statistical methods, as a support system for decision making in small enterprises, can lead to better business results (Žmuk, 2015). Managers and other professionals with business experience should consider relevant statistics for optimal decision-making on complex capital budgeting decisions and accounting issues (Wainberg, 2018). Furthermore,

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managers in industrial processes need knowledge of statistical techniques in modeling and optimizing data to improve quality of industrial processes (Sant'Anna, 2015).

Statistical tools are key components of quality management support and production process analysis, enabling managers to anticipate business and production conditions in different ways (Orzes & Bo', 2019). Knowledge of methodology is vital for project managers to be able to evaluate their project in terms of measurement instrument use and to analyze results of method used (Kononenko & Lutsenko, 2019). The same applies to other specific management areas, such as strategic management in the field of forest resources, which requires use of analytical methods to maximize function and value of forests (Grošelj, Hodges & Zadnik Stirn, 2017). That is why the challenge of future commercial prospects, which increasingly take into account data in decision-making, and thus consequently affects changed DNA and performance of organizations, is in changing mindset and way of thinking of managers and other employees (Carillo et al., 2019).

In researching statistical literacy and responding to social change in today's long-lived society, characterized by most developed societies, one may wonder whether it is sufficient to focus solely on the level of social actor, or whether it is sensible to upgrade research to the level of generations. As Bolin (2019) points out it is not enough to understand social change by focusing solely on just one generation, three generations - young, middle-aged and elderly - were included in our study.

In order to understand the complexity of systematically organized research background, two determinants should be highlighted. The first explaining that statistical knowledge and statistical literacy development among Slovenian generations are weak, confirmed also by some international researches. Researches[1], involving young learners in the past two decades, have shown they lack knowledge of data processing/statistics (Ferligoj, 2015; Lipič, 2015). Quality Indicator for adult knowledge, measured by achievements in 1998 The International Adult Literacy survey (the last survey where Slovenia participated), ranks us last among participating countries (Dovžak et al., 2014). The study included areas of reading, writing and numeracy, which also covers statistics.

Second determinant relates to provision of formal and informal forms of statistics education in Slovenia for all generations, including the elderly. Research by Lipič (2015) shows statistical training is very modest or nonexistent in some professional and subject areas. The latter is mainly for young generation, less for the middle-aged and almost none for the elderly. Our research focuses on statistical literacy issues in Slovenia in times of social change as various experts, over the past few decades, have been repeatedly warning us of lack of statistical knowledge and poor development of statistical literacy of individual Slovenian generation.

The starting point for our research is conscious reflection of educational environment in Slovenia to improve statistical literacy, which poses a challenge for a more effective response of social actor from individual generations to environmental social changes. Nowadays, the needs of all three generations for lifelong learning and statistics education require a new paradigmatic shift in individual awareness towards enhancing competence in statistical knowledge to understand complexity and variety of environmental changes.

The main objective of this paper is to determine response efficacy of a better statistically literate social actor to environmental changes from the perspective of different generations in Slovenia.

Two research questions are:

- Which factor educational barrier, statistical literacy and competence of education system, has the biggest influence on social actor's responsiveness to environment changes?
- Which factor educational barrier, statistical literacy and competence of education system, has the biggest influence on social actor's responsiveness from specific generation to environmental changes?

2 Theoretical framework

2.1 Complexity of change in social and educational environment

The following section presents theoretical framework for understanding complexity and dynamics of change a social actor faces in environmental interactions. In the next section, the need to cope and respond to changes in social and educational environment will be upgraded with context of individual's needs for involvement in statistics education and statistical literacy development by applying these findings.

According to Holloway (2010, 12), social change is the result of barely visible transformation of daily lives and activities of millions of people. It is every human being's responsibility to oppose to or reject things in one's life s/he believes damage the quality of one's life and possibility of personal growth in this changing society (Earl, 2014). Social change is any action, progressive or regressive, effective or ineffective, aimed at changing outcomes (Pratto, Stewart, & Bou Zeineddine, 2013, 139).

As early as the 1960s, Vaizey (1961, 7) wrote that relationships between economic growth, social change and in-

[1] IAEP, School Children´s Acquisition and Maintenance of Quantitative Thinking in Mathematics, PISA, TIMSS.

vestment in education were important and complex. Nowadays, Erol (2011) adds that education itself does not play a major role in the process of social change, as economic, political, and other positions of power in society are predominant. However, education in a holistic understanding of social change is one of the indispensable factors, as it provides opinions, directions, forms and theories of social change.

Education promotes social change, which is mirrored differently in different environments by different social and political backgrounds, philosophical reasoning and educational approaches. These different approaches to social change are mirrored on the level of participant, financial support of governments and organizational system (Chang, 2013). Creative social change promotes a uniquely connected dialogue between leadership, sustainability, the long-term survival of our planet and organizational development (Schuyler Goldman & Jironet, 2016). Education influences faster development of an individual and, at the same time, higher efficiency of all organizational structures, as when education is discussed, development of individual achievements are in question (Drucker, 2001, 59).

New technologies and emergence of knowledge economy have changed traditional concept of work and education, so lifelong learning and gaining qualifications today last a lifetime not just in certain stages of life. We cannot prepare for a successful life in an ever changing world and cope with change only once in our lives, in childhood and adolescence, we should constantly learn in terms of »lifelong« and »lifewide«, therefore, lifelong learning is increasingly becoming a guiding principle and basic social development strategy of education and learning. Nowadays, one's learning is not only a starting point for job promotion, but also the ability to successfully cope with social change, as learning should become an entity of one's everyday life and an expression of one's lifestyle and identity for success in society.

The ability to adapt to social transitions is a challenge for schools, which should go beyond outlived socialization of students on the status quo level and strive to educate students who are proactive actors of social change (Trotta Tuomi, 2005). In modern schools, moving away from capitalist orientations, social change should mirror construction of cultural pluralism, redistribution of socioeconomic status and sociocultural recognition of identities and differences (Rodrigues, 2012). Social change ensures that social cultural values are passed on to future generations, thereby contributing to existence and preservation of social tradition. In times of rapid change, even education faces such change as cultural heritage of society passes through education onto next generation (Turhan, 2005).

Social change should stem from and be realized within a family before they can change others as in a socially constructive paradigm, a family forms a community and more families form a nation (Alden Rivers, Hazenberg, & Bajwa-Patel, 2015). Participation of young people in society, and coping with social change, is essential for promoting young people's identity as citizens within a democratic context, developing their skills in useful situations and supporting their personal development (Checkoway, 2011). Through participation, young people enter intersection of social events and become catalysts for positive social change (Nejati, Pourezzat, & Gholipour, 2012, 411).

2.2 Importance of statistical literacy in a society of change

Understanding technological, financial and social changes is also conditioned by understanding their statistical context. Therefore, theoretical framework, focusing on whole population or partially on individual age groups of learners, is discussed. This will help us understand statistical literacy needs from perspective of individual generations. Such complex researches are rare.

In globalization, statistics play an important role in different human activities as it is used in various social, economic, industrial, educational and other fields (Takaria & Talakua, 2018, 396). Statistics infiltrate and affect every aspect of our lives as media and advertisements try to influence our views and responses. Statistics play an increasingly important role in understanding social and economic development and progress (Feng et al., 2011, 90). Therefore, the importance of statistical literacy in modern society is essential as it has now become a key reading and writing competence (Baniyas, 2017, 980). The focus on statistical literacy has increased over the past two decades (Budgett & Rose, 2017, Callingham & Watson, 2017; Watson, 2013) as the construct of statistical literacy continues to evolve with social change, posing a challenge to educational systems and teachers (Gal, 2019).

Statistical literacy means understanding and using basic statistical language and tools: knowing what basic statistical terms mean, understanding simple use of statistical symbols, recognizing and being able to interpret different data representations. Statistical literacy is defined as a key competence expected of citizens in information societies, is often promoted as expected outcome of schooling and is a necessary component of literacy and adult numeracy (Garfield, 2011).

Statistical literacy is a concept recently attracting a great deal of research interest among statistical education researchers regarding its elements (Contreras & Molina-Portillo, 2019). Ferligoj (2015, 6) sees success for improving statistical literacy in coordinated collaboration of educational institutions, statistical offices, statistical associations and the media.

One of basic arguments of statistical literacy is that individuals are literate for their roles as citizens in society (Weiland, 2017, 34). Today, good command of statistics is also required to evaluate, identify issues and support when selecting interventions, predict future, monitor progress

and evaluate results and impacts of policies and programs (Sanga, 2011, 1262). As stated by Nicholson, Ridgway, and McCusker (2013) and Wild (2017), statistical culture is constantly changing, new forms of communication and discourse, new forms of visualization and human interaction with data mean that what may have been useful a few years ago is no longer adequate.

Use of statistical information is becoming increasingly important for citizens in carrying out their professional and private activities and is essential for their active participation in society. It is difficult to understand various economic and social processes without use of statistics in today's complex world (Todorova, 2018, 390). Use of misleading heuristic-based graphics can often be identified when presenting information in the media, which prevent the user from realizing one is being misled (Contreras et al. 2017; Sutherland & Ridgway, 2017). Statistically literate people, who know how to understand, interpret, and evaluate statistics, will also be able to use these skills to plan future actions with compelling arguments and contribute to evidence-based policy development (Baniyas, 2017, 974).

According to Weiland (2017, 34), social change dictate changes in teaching mathematics or statistics, as Auliya (2018) specifies, general perception of mathematics and statistics influences students' statistical literacy skills. Weiland (2017, 34) continues to say that school mathematics curricula, where statistical education is firmly rooted, should also address and explore large-scale socio-political issues such as systemic racism, class distinctions, climate change, refugee crisis, immigration, poverty, food shortages, waste and environmental pollution. From this perspective, Weiland (2017, 40) expands the concept of statistical literacy with the concept of critical literacy and defines the concept of critical statistical literacy. This contributes to students as critical citizens, supported by learning powerful statistical concepts and practices, address complex socio-political issues (Weiland, 2017, 45).

Engel (2019) finds the answer to the question of how we can prepare students to understand statistical data and look at trends and changes on key social issues, such as demographic change, crime, unemployment, fair wages, migration, health, racism and other social fields, by expanding the notion of statistical literacy into civic statistics. Nicholson, Gal, and Ridgway (2018) outline eleven aspects of statistical literacy that define civic statistics when answering social questions. They are essential for social policies, as both statistical knowledge and social or socio-economic context are required. From this perspective, Nascimento (2019) explains statistical literacy as one of important competences also needed to understand and achieve the UN Sustainable Development Goals 2030. These goals require global action by governments, enterprises and civil societies in tackling social inequality, poverty, climate change, peace, security, human rights, environmental protection and allowing a decent life and opportunities for all.

Statistics play an important role in the digital economy, which plays an increasingly important role in transformation of almost all parameters of modern society today. At the forefront are challenges incurring in the process of digitalization of manufacturing and management activities within economy, which is based on widespread use of digital technologies. That is why it is important to encourage development of modern personnel for digital economy, without which it is practically impossible to achieve significant increase in social production efficiency (Karmanov & Klochkova, 2018, 78).

In Slovenia too, increasing role of statistics in information society raises importance of statistical literacy, defined as ability of users to use and transmit statistical information in an appropriate and professional manner. In past decades, major part of statistical education with development of statistical literacy, statistical reasoning and statistical thinking, has been implemented mainly in primary and secondary schools. Today, more attention is put on quality statistical education of students in Slovenia. The Brezavšek, Šparl and Žnidaršič (2014) survey, carried out with the help of the Technology Acceptance Model, offers guidance to social science education lecturers to understand and use SPSS program better. Above all, future task of educational institutions, statistical institutions, statistical societies and other actors in the field of statistics, is to improve statistical literacy of different social classes (Ferligoj, 2015, 8-9).

In our modern mass societies, knowledge and skills, properly supported by data, are an important prerequisite for democracy to work. In an increasingly complex world, citizen's input is an important resource for national and local policymakers. In doing so, public debate is based on facts rather than emotions and promotes evidence-based policymaking (Engel, 2016).

In the light of democratization, an independent movement, The Radical Statistics Group, which has for the past four decades included mainly English statistics, researchers and interested citizens, has been advocating the use of statistics in support of progressive social change. (Evans & Simpson, 2016).

Statistical literacy is generally important for full social participation (Steen, 2001) and informed citizens (Tractenberg, 2017). In modern knowledge society, use of statistical information is a necessary skill for citizens (Todorova, 2018). In a society of change, which offers substantial amount of information at any given moment, recipients of information, published in various media, are expected to become active citizens who will understand statistics of the public sphere (internet, press, radio, television, producers of official statistics, etc.) and know how to verify all based on their own knowledge, which includes context knowledge, basic mathematics, knowledge of (at least) elementary statistics, graphical and numerical tools suitable for presenting data with critical thought and willingness to accept evidence. Therefore, it is necessary to integrate ba-

sic elements of statistical education into mathematics curricula so that citizens are adequately statistically educated (Contreras & Molina-Portillo, 2019).

3 Methodology

3.1 Methods, techniques for collecting and processing data

Research into effectiveness of response of statistically literate social actors from different generations in Slovenia on environmental changes was carried out using relevant quantitative methodology. Descriptive and inferential statistical methods were applied.

Statistical analysis of empirical data, collected through our own questionnaire in 2015, was performed using the SPSS program (version 21). Properties of variables were analyzed and presented in tables together with frequencies, arithmetic means and standard deviations.

Data was collected in 2015. It was collected by a written survey of 1st year students of Physical Therapy and Social Gerontology courses at Alma Mater Europaea - European Center, Maribor. According to individual generations, all other sudents' family members were also included in the study. Students were interviewed before methodological approach was done.

Multivariate statistical methods were used in statistical analysis, namely factor analysis using principal axis factoring (PAF). The significance of factor analysis use was tested by the Kaiser-Meyer-Olkin criterion (KMO) of sample adequacy, which measures strength of overall correlation between variables (homogeneity) of variables, and Bartlett's Test of Sphericity, which serves to verify whether there is statistically significant difference between our inter correlation matrix and the unit matrix. By performing individual factor analyses for each four sets of indicators used in this paper, substantive validity of each construct was confirmed and new variables for further analysis were obtained.

Cronbach's alpha coefficient was used to evaluate reliability of measurement or to evaluate internal consistency of measurement scale.

Multiple linear regression analysis was also used to explain influence of independent variables on dependent variable. When determining relationship between dependent and multiple independent variables, regression model was used, where values of independent variables were used to predict value of dependent variable in the entire sample and three subsamples according to age group or generation.

3.2 Description of instrument

The empirical data was collected by using our own questionnaire, which is the result of studying relevant literature and synthesizing all these insights into final theoretical construct. Participating respondents in the survey were voluntary and anonymous. Ethical survey principles and standards were followed.

In January 2015, a pilot survey of adequacy and reliability of questionnaire as an instrument for empirical data collection was performed on a sample of twenty-four people, eight from each generation.

Paper presents complex research results with a large survey questionnaire. On average, respondents answered it within 30 minutes. Only data relevant to research presented was applied. Questionnaire included close- and open-ended questions.

Measurement scale has five values (Likert scale), where 1 indicates respondent's position as very unsupportive and 5 respondent's position as very supportive. All statements, used in multivariate analyses, were measured using this ordinal scale.

The questionnaire consists of three completed units. The first includes questions about respondents' demographics. The second consists of question of participation in education in statistics. The third consists of a set of statements related to statistical literacy identifying respondents' points of view from various research aspects.

3.3 Sample

In identifying response efficacy of better statistically literate social actors from different generations in Slovenia to environmental changes, the perspective of all three generations was applied: young generation, aged 18 - 25, the middle-aged, 26 - 64 and the elderly, aged 65 and over. In defining individual generation age limits, Slovenian cultural milieu was taken into consideration and only Slovenian experts' interpretations were used. In younger generation, the lowest age consent, i.e. 18, was acknowledged.

Two-stage sampling was designed. The first used stratified sampling, as population was divided according to age criteria into individual generations. This was followed by convenience (casual) sampling within each individual generation.

Survey included 1239 respondents: 409 from younger generation, aged 18 to 25, 452 were middle-aged (26 to 64) and 378 were elderly thus aged 65 years or older. Our sample does not represent the distribution of entire population of Slovenia.

4 Results

4.1 Descriptive Statistics

To understand basic demographic characteristics of respondents' age, gender and educational structure should be analyzed separately for each generation.

Age structure of survey sample (Table 1) shows that 33% of respondents are from the young generation, i.e. 18 - 25 years, 36.5% are middle aged (26 to 64) and 30.5% are elderly, aged 65 years or over.

55.3% female respondents and 44.7% male respondents were included in the survey (Table 2). This is comparable to Slovenian population also dominated by women. Young generation consists of 57.2% female respondents and 42.8% male respondents, middle-aged includes 54.9% female and 45.1% male respondents and 53.7% female and 46.3% male respondents are form the elderly generation.

Educational structure of respondents by generations (Table 3) indicates that majority of respondents of all three generations completed high school. College education follows in the young and middle-aged, vocational in the elderly generation. Third place is vocational in the young and the middle-aged, primary education in the elderly generation.

Table 1: Age structure of respondents by generation.

Generation	*f*	*f* in %
18–25 years	409	33.0
26–64 years	452	36.5
65 years or older	378	30.5
Total	1239	100.0

Table 2: Gender structure of respondents by generation.

Gender	Generation					
	18 to 25		26 to 64		65 and over	
	f	*f* in %	*f*	*f* in %	*f*	*f* in %
Female	234	57,2	248	54,9	203	53,7
Male	175	42,8	204	45,1	175	46,3
Total	409	100,0	452	100,0	378	100,0

Table 3: Educational structure of respondents by generation.

Education	Generation					
	18 to 25		26 to 64		65 and over	
	f	*f* in %	*f*	*f* in %	*f*	*f* in %
No education	0	0,0	1	0,2	12	3,2
Primary school	27	6,6	18	4,0	79	20,9
Vocational school	36	8,8	62	13,7	82	21,7
Secondary school	269	65,8	162	35,8	104	27,5
College	12	2,9	51	11,3	43	11,4
Higher school	16	3,9	42	9,3	15	4,0
University	43	10,5	85	18,8	29	7,7
Specialization	0	0,0	6	1,3	4	1,1
Master	6	1,5	15	3,3	5	1,3
Doctorate	0	0,0	10	2,2	5	1,3
Total	409	100,0	452	100,0	378	100,0

In order to understand response efficacy of social actor from individual generations to environmental changes, structure of respondents according to participation frequency in statistical knowledge course in the past three years and especially in 2014 is presented (Table 4). When participating in statistics education, formal and non-formal education were included. 2014 was chosen as survey was conducted in 2015. Structures are presented separately for all three generations.

Results show that respondents aged 18 to 25, most frequently attended statistics course in 2014 and the past three years. The lowest participation in statistics course in the past three years and in 2014 is, as expected, among respondents from the older generation, aged 65 and over.

In the past three years, 39.9% of young generation respondents, 23.7% of middle-aged and 6.3% of old generation attended statistics course.

In 2014, 27.1% of young generation respondents, 16.2% of middle-generation respondents and 6.3% of old-generation respondents attended statistics course.

Table 4: Participation frequency of respondents of different generations in statistical training in the past three years and in 2014.

Participation	Generation					
	18 to 25		26 to 64		65 and over	
	Last three years	In 2014	Last three years	In 2014	Last three years	In 2014
	f in %	*f* in %	*f* in %	*f* in %	*f* in %	*f* in %
Never	60,1	72,9	76,3	83,8	93,7	93,7
Once a year	18,6	12,0	11,7	8,8	2,6	3,2
Twice a year	3,7	3,9	4,9	2,9	1,6	1,6
Thrice a year	5,1	3,9	2,9	1,5	0,8	0,5
Four times a year	2,7	1,0	0,4	0,4	0,5	0,0
Five or more times per year	9,8	6,4	3,8	2,4	0,8	1,1
Total	100,0	100,0	100,0	100,0	100,0	100,0

4.2 Factor analysis

Using Principal Axis Factoring (PAF) method, factor analysis reduced number of variables by introducing synthetic variables or factors.

Below only a part of a complex survey, identifying eight factors of lifelong statistical education from different generations' perspective in Slovenia, is presented. The paper focuses only on four factors that are relevant to our two research questions. Table 5 shows results of each factor analysis for each one of four sets of indicators used in this paper to confirm substantive validity of each construct and obtain new variables for further analysis. These factors are "response to change", "statistical literacy", "educational barriers" and "competence of the education system". Factors "response to change" and "statistical literacy" include seven, "educational barriers" factor nine and "competence of the educational system" factor five variables.

Results in Table 5 show that all four factors can confirm, using KMO and Bartlett's test, data adequacy for factor analysis. KMO ratios are in all cases greater than 0.5 and with risk less than 0.05 null assumption that correlation matrix is equal to unit matrix (Bartlett's Test of Sphericity) can be rejected. On this basis, confirmatory factor analysis followed confirming for each four constructs that one factor was obtained, where factor loadings were everywhere correspondingly high and strongly correlated with single factor (0.6 or more) and degree of explained variance adequate (response to changes 73.1%, statistical literacy 54.9%, educational barriers 64.9% and competence of education system 65.1%). Individual scree plots with clear curve break behind first factor indicated single factor result. Obtained factors were stored as new variables using regression coefficient method and used for further analyses and/or analyses testing regression models. All factors in the research have Cronbach's alpha values slightly below or above 0.900, thus one can speak of excellent measurement reliability or accuracy or internal consistency.

Total scores of individual constructs show "statistical literacy" as the highest rated construct with average score of 3.45 (SD=0.78), which means respondents associate statistical literacy with the highest level of importance in conscious coping with complexity and dynamics of changes and competent response to them. This is followed by "response to change" with average score of 3.03 (SD=1.02), which is, according to the scale used, average

Table 5: Factor analysis results.

Factor / Construct	Questions - Variables	Cron-bah's α	Eigenvalues, Explained Var. *(EV)*	KMO, Bartlett's test	Factor Loadings	Average Mean, *SD*
Response to change (*N*=1239)	With statistical knowledge, I can understand social changes better (e.g. unemployment, natural growth…).	0.950	$\lambda 1 = 5.386$ $\lambda 2 = 0.426$ *EV*=73.151%	0.921 $p<0.0001$	0.831	*M*=3.03 *SD*=1.02
	With statistical knowledge, I can understand changes in nature better (e.g. weather analysis…).				0.849	
	With statistical knowledge, I can understand technological change and progress better.				0.898	
	With statistical knowledge, I can understand economic changes better (e.g. inflation, oil prices, ...).				0.890	
	With statistical knowledge, I can understand financial changes better (e.g. stock markets, interest rates, taxes, etc.).				0.866	
	With statistical knowledge of statistics, I can understand scientific progress better.				0.838	
	With statistical knowledge, I can understand media publications better.				0.812	
Statistical literacy (*N*=1239)	The importance of statistical literacy is increasing in today's society.	0.894	$\lambda 1 = 4.289$ $\lambda 2 = 0.669$ *EV*=54.975 %	0.893 $p<0.0001$	0.712	*M*=3.45 *SD*=0.78
	Statistical literacy is important for social development.				0.800	
	Statistical literacy is important for technological progress.				0.728	
	The importance of statistical education in schools is increasing.				0.635	
	Development of statistical literacy is a lifelong process of learning.				0.788	
	The concept of lifelong learning enables development of statistical literacy.				0.793	
	Development of statistical literacy must be continued also after completion of formal education.				0.720	

Table 5: Factor analysis results (continued).

Factor / Construct	Questions - Variables	Cron-bah's α	Eigenvalues, Explained Var. *(EV)*	KMO, Bartlett's test	Factor Loadings	Average Mean, *SD*
Educational barriers (*N*=1239)	I do not attend statistics course for fear of failure.	0.936	$\lambda 1 = 6.140$	0.938	0.620	*M*=2.11
	I do not attend statistics course due to lack of support and encouragement from the employer.		$\lambda 2 = 0.816$	*p*<0.0001	0.760	*SD*=0.90
	I do not attend statistics training because of lack of support and encouragement from my immediate family (family members).		*EV*=64.981%		0.903	
	I do not attend statistics course due to lack of support and encouragement from other relatives.				0.925	
	I do not attend statistics course due to lack of support and encouragement from my close friends.				0.923	
	I do not attend statistics course due to lack of support and encouragement from colleagues (or former colleagues) or classmates.				0.909	
	I do not attend statistics course due to lack of support and encouragement from acquaintances.				0.879	
	I do not attend statistics training due to lack of money.				0.625	
	I do not attend statistics course due to lack of training offer.				0.612	
Competence of education system (*N*=1239)	Slovenia offers poor supply of formal statistics education (ex.: schools, colleges, etc.).	0.901	$\lambda 1 = 3.590$	0.851	0.763	*M*=2.97
	Slovenia offers poor supply of non-formal statistics education (ex.: societies, organizations, …).		$\lambda 2 = 0.564$	*p*<0.0001	0.812	*SD*=0.85
	Statistics education system in Slovenia is poor.		*EV*=65.139 %		0.890	
	Statistics education system in Slovenia is deficient.				0.862	
	Slovenia has uneven regional and local access to statistics education.				0.694	

or neutral rating. This indicates a semi moderate or moderate awareness among respondents that in today's social, economic and technological environment, it is not enough to face changes, but also to react proactively to them. The lowest scores are achieved by "competence of education system" with average score of 2.97 (SD=0.85) and "educational barriers", where average score of 2.11 (SD=0.90) essentially indicates absence of assessed barriers.

The correlation between factor and variable is expressed by factor loading. The greater the factor loading, the more factor is related to the variable. Recommended minimum value of factor loading is ± 0.3, which is true of all values of variables in our research. Factor "response to changes" shows the highest value of factor loading is variable "with statistical knowledge I can understand technological change and progress better'' (0.898), factor "statistical literacy'' variable "statistical literacy is important for development of society" (0.800), factor "educational barriers" variable "I do not attend statistics education due to lack of support and encouragement from other relatives" (0.925) and "competence of education system'' variable "statistics education system in Slovenia is poor". All value loadings are relatively high and indicate that selected claims, belonging to a particular factor, well define factor content.

4.3 Regression Analysis

Regression analysis of lifelong statistics learning determined interdependence between two or more groups of variables. In particular, multiple linear regression analysis to determine, the relationship between three independent (statistical literacy, educational barriers and competence of education system) and one dependent variable (response to change) was used. Preliminary analysis confirmed there were no multicollinearity among variables and that there was no deviation from criteria regarding normality of residual distribution and homoscedasticity.

Regression analysis was used for two research questions. First regression model, trying to answer first research question, examined which independent variable "educational barriers", "statistical literacy" and "competence of the education system" has the greatest influence on social actor's responsiveness to environmental changes, which represents dependent variable "response to change".

Table 6 shows that three independent variables, in standard model according to ANOVA statistics (F=154.249; p<0.001), significantly predict dependent variable »response to change«. One can conclude that due to standard regression analysis, model degree of predictability dependent variable was found to be R=0.522. The model degree of explanatory variance in dependent variable was R2=0.273. Looking at these coefficients, one can say model predicts dependent variable very well.

Table 6: Model summary and ANOVA.

	R	*R* Square (R^2)	Adjusted *R* Square	Std. Error of the Estimate	
Model Summary	0.522	0.273	0.271	0.833	
ANOVA	Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Regression	321.302	3	107.101	154.249	0.000

Table 7: Multiple regression coefficients.

	Unstandardized Coefficients		Standardized Coefficients	*t*	*Sig.*	Collinearity Statistics	
Model	*B*	Std. Error	Beta (β)			Tolerance	*VIF*
Constant	0.001	0.024		0.022	0.982		
Educational barriers	0.069	0.025	0.070	2.825	0.005	0.969	1.032
Statistical literacy	0.447	0.026	0.435	17.411	0.000	0.945	1.058
Competence of educational system	0.185	0.026	0.182	7.223	0.000	0.932	1.073

Absolute value of Beta (β) in table 7 indicates order of importance of independent variables. Variable with the highest β value is relatively the most important independent variable. By examining contributions made by the independent variables in the model, final results, collected from "statistical literacy", made the biggest contibution with value of (β=0.435; p<0.001). Values "competence of educational system" (β=0.182; p<0.001) and "educational barriers" (β=0.070; p=0.005) follow respectively.

Results of first regression analysis answers the first research question, which independent variable "educational barriers", "statistical literacy" and "competence of the education system" has the greatest influence on social actor's responsiveness to environmental changes, which presents dependent variable "response to change." Based on first regression model results, statistical literacy has, among independent variables "statistical literacy", "educational barriers" and "competence of the education system", the largest and statistically significant influence on social actor's responsiveness to environmental changes. This points to a focus where, in the future, it is necessary to find optimal solutions for planning, organizing, implementing and evaluating this type of statistical education, which, by emphasizing importance of statistical literacy, will enhance individual's responsiveness to environmental changes.

Secondly, research was expanded to examine differences between age groups and/or generations. Second research question in second regression model checked which independent variable "educational barriers", "statistical literacy" and "educational system competence" has the greatest influence on individual social actor's responsiveness to environmental changes. The approach to increase research to generations and perform regressions on individual generations stems from the need to adapt both formal and informal statistical education to educational needs of each generation. This also results in ability of individual generation to respond to change. Dependent variable "response to change" presents the latter in our regression model.

In identifying differences between generations, data in Table 8 show that independent variables "educational barriers" (p<0.001), "statistical literacy" (p<0.001) and "educational system competence" (p<0.001) statistically significantly affect dependent variable "response to change" in all three models. Generation 65 years and older has the strongest explanatory power of model, where independent variables explain 31.4% of variability of dependent variable. Generation aged 26-64 follows, where independent variables explain 27.7% of variability of dependent variable. Generation 18-25 has the weakest explanatory power of the model, where independent variables explain 21.7% of variability of dependent variable "response to change".

When comparing predictive power of independent variables "educational barrier", "statistical literacy" and "educational system competence" for dependent variable "response to change" by generations in Table 9, "statistical literacy" ($\beta_{18\text{-}25}$ = 0.432, $p_{18\text{-}25}$=0.000; $\beta_{26\text{-}64}$=0.435, $p_{26\text{-}64}$=0.000; $\beta 6_{5+}$=0.436, p_{65+}=0.000) has the strongest influence with independent variable in all three generations. Influence of independent variable "competence of education system" ($\beta_{18\text{–}25}$=0.093, $p_{18\text{–}25}$=0.042; $\beta_{26\text{–}64}$=0.180, $p_{26\text{–}64}$=0.000; β_{65+}= 0.245, p_{65+}=0.000) follows for all three generations. Independent variable "educational barriers" has only a statistically significant effect on dependent vari-

Table 8: Model summary and ANOVA.

	R	*R* Square	Adjusted *R* Square	Std. Error of the Estimate	
Model Summary					
Generation 18 – 25 year olds	0.465	0.217	0.211	0.837	
Generation 26 – 64 year olds	0.526	0.277	0.272	0.810	
Generation 65 years old and more	0.560	0.314	0.308	0.842	
ANOVA	Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Regression					
Generation 18 – 25 year olds	78.334	3	26.111	37.308	0.000
Generation 26 – 64 year olds	112.303	3	37.434	57.041	0.000
Generation 65 years old and more	121.358	3	40.453	57.010	0.000

able "response to change" (β_{65+}=0.105, p_{65+}=0.017) in generation 65 years old and older.

Results of the second regression model answer the second research question, which independent variable "educational barriers", "statistical literacy" and "competence of education system" has the greatest influence on responsiveness of social actor from each generation to environmental changes. Based on second regression model results, which was extended with generational perspective of three generations from 18 to 25, 26 to 64, and 65 years old and over, statistical literacy has, among independent variables "statistical literacy", "educational barriers" and "competence of education system", the largest and statistically significant influence on dependent variable "response to change" and/or on social actor's responsivness from all three generations to environmental changes.

One can deduce that first regression results, performed on the whole sample, and second regression set, performed on generations, point in the same direction: statistical literacy is crucial in responding to change. This is the starting point for (re)defining statistics education system in Slovenia for the needs of individual generations.

Table 9: Multiple regression coefficients.

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	*Sig.*	Collinearity Statistics	
	B	Std. Error		Beta (β)			*Tolerance*	VIF
Generation 18 – 25 year olds	Constant	0.030	0.042		0.723	0.470		
	Educational barriers	0.008	0.046	0.007	0.167	0.868	0.980	1.020
	Statistical literacy	0.457	0.048	0.432	9.463	0.000	0.927	1.079
	Competence of educational system	0.092	0.045	0.093	2.037	0.042	0.933	1.072
Generation 26 – 64 year olds	Constant	0.076	0.039		1.985	0.048		
	Educational barriers	0.069	0.040	0.071	1.723	0.086	0.957	1.045
	Statistical literacy	0.459	0.044	0.435	10.444	0.000	0.933	1.072
	Competence of educational system	0.189	0.044	0.180	4.318	0.000	0.927	1.079
Generation 65 years and more	Constant	-0.104	0.044		-2.363	0.019		
	Educational barriers	0.101	0.042	0.105	2.390	0.017	0.954	1.049
	Statistical literacy	0.420	0.042	0.436	10.016	0.000	0.968	1.033
	Competence of educational system	0.248	0.045	0.245	5.494	0.000	0.925	1.081

5 Discussion

Research results show that statistical literacy influences social actors' responsiveness to environmental changes in the whole sample and all subsamples or generations.

When comparing predictive power of independent variable "statistical literacy" for dependent variable "response to change" by generations, we find that the strongest influence is 26 to 64, followed by 65 and older and 18 to 25 generation. This is an indicator of the urgency of systemic change in improving statistical literacy to improve responsiveness to change in 18 to 25 and 65 and older generation. More attention on necessity for statistical literacy of individuals both in professional and personal life, will have to be channeled to educating and awareness-raising in all generations, improving offer and accessibility of formal and informal forms of statistical education for all generations.

We live in times where change is the only constant of an individual's life, so one's response to various changes is crucial. Even those bringing changes in lifestyles at different milestones in life, which can trigger psychosocial conflict in psychosocial personality development according to Erikson (1976). A favorable solution of psychosocial conflict enables transition to the next level of psychosocial development of an individual. Erikson (1976) thinks, adults can achieve integrity by "settling their life accounts" in satisfaction of being statistically literate, interacting with others in lifelong statistical learning and responding effectively to changes in educational, social, and technological environment. These changes can be life's victories or disappointments. Thus, an individual "matures" gradually deriving from experience of all previous seven stages (Erikson, 1976). Integrity is expressed as a confirmation of human affection for one's life and acceptance of a single life cycle. It is vital one takes responsibility for one's life.

Responding to change also means we can act differently. According to Giddens (1984: 14), ability to act differently means the ability to intervene in the world or refrain from such an intervention by which we can influence a particular process or state of affairs. Action depends on individual's ability to cause change in an existing state or set of events. If an actor loses this power, one ceases to exist, or, as Giddens claims, this can happen with one's death. Power, in this concept, is not resource needed in action, but applies to every action. In a comprehensive sense, power comes before subjectivity.

Social change response strengthens age integration, which can establish a new paradigm of activity of social actors from each generation. According to this new paradigm, education, work, and leisure will not, as in the past, only determine certain life stages, but each individual will also actively participate in entire life cycle. It is an entity of an inclusive society, where social, economic and organizational aspects of inclusion in lifelong learning - including statistics - are equally balanced.

Due to constant social, technological and economic changes, social actor is, in interaction with social environment, constantly confronted with the need of acquiring new knowledge and different competences. Participants of lifelong learning and lifelong statistical learning should be prepared for ever-changing environmental requirements. The latter enables them to analyze environment reflexively, identify their own educational needs, make conscious choices to engage in new forms of lifelong learning and successfully adapt to environmental changes. Basic aim of statistical education today is aimed at acquiring such knowledge, skills, and competences that will enable them to use statistics in their daily and professional life - which means developing statistical literacy. Statistical literacy is primarily understanding and using statistical language and tools. Statistically better literate social actors participate fuller and more actively in working, personal and social environment and respond more effectively to environmental changes.

6 Conclusion

The research aims to contribute to understanding circumstances contributing to each generation's representative decision to participate in statistics education, moreover, in lifelong statistics learning. This will contribute to development of statistical literacy to cope more effectively and respond to changes in personal and/or professional life in age stages. Statistics education will not only involve the younger generation and perhaps partially the middle-aged generation. This is also an opportunity to educate the elderly, which follows trends of longevity of Slovenian ageing society, labour market needs to extend years of service and face changes in professional environment even in the old age.

Research results will, in the process of planning, implementation and evaluation of statistics education effects, benefit all generation participants, educational institutions and wider social environment. This ensures lifelong statistics learners educational and social equality, encouragement with decision making to integrate and continuous lifelong learning and use of statistics, thereby improving their statistical literacy, which will help them respond to environmental change and be more socially integrated in social environment. Research results will also be useful for educational institutions and other institutions involved in lifelong learning process of different generations. Through research findings, they will be able to strengthen their efforts to achieve a higher education competency in the field of lifelong statitistics learning.

Research also answers questions, which are today, in new and changing social contexts, crucial for the role and importance of statistics in knowledge society: how to provide different generation users with appropriate, relevant

and accurate statistics data regarding diverse social, economic, technological and economic phenomena, and how to train users of different generations, in the light of developing statistical literacy, to use this data correctly. All this contributes to a better social actor's responsivneness to change, enhances individual's competitiveness, innovation and creativity and strengthens active citizenship.

Stereotypical view, of representatives of different generations, of statistics as a science or field which is useless in everyday life, that learning statistics is difficult and that statistics cannot be learned when older, often limits the research. Another limitation is underdeveloped, incompetent and non-responsive system of statistics lifelong learning in Slovenia. Research limitation is also that our research results cannot be relevantly compared as similar national or international research on different generations has not been done yet. When upgrading the research, it would be worth considering new sampling, which would be coincidental and would cover all Slovenian regions. Research could also be upgraded by taking into account involvement frequency of representatives of all generations in statistics education over a longer period of time (especially relevant for the elderly and middle-aged generation), and not only during three selected years.

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Vpliv statistične pismenosti na odzivanje na spremembe v okolju

Ozadnje in namen: Ob stalnih družbenih, tehnoloških in ekonomskih spremembah se socialni akter v interakciji z okoljem permanentno sooča s potrebo po usvajanju novega znanja in razvijanju različnih kompetenc - tudi na področju statistike. To mu ob ustrezno razviti statistični pismenosti omogoča refleksivno analizo okolja in odzivanje na spremembe v okolju. Namen prispevka je preučiti učinkovitost odzivanja bolje statistično pismenega socialnega akterja na spremembe v okolju s perspektive različnih generacij v Sloveniji.
Zasnova/Metodologija/Pristop: Empirične podatke smo zbrali z anketnim vprašalnikom ter jih obdelali in analizirali z izbranimi metodami deskriptivne in inferenčne statistike. V raziskavo smo vključili 1239 anketirancev vseh treh slovenskih generacij. Zastavili smo si dve raziskovalni vprašanji, kjer se eno nanaša na celotni vzorec in drugo na tri podvzorce glede na starostne skupine oziroma generacije.
Rezultati: Na celotnem vzorcu in tudi v vseh treh generacijah ugotavljamo, da statistična pismenost vpliva na odzivnost socialnega akterja na spremembe v okolju. Rezultati raziskave kažejo, da bolje statistično pismeni socialni akterji bolj polno in aktivno delujejo v delovnem, osebnem in družbenem življenju in se učinkoviteje odzivajo na spremembe v okolju.
Zaključek: Več pozornosti o nujnosti razvoja statistične pismenosti pri posamezniku, tako v poklicnem, kot tudi vsakdanjem življenju, bomo morali usmeriti v osveščanje in ozaveščanje vseh generacij o pomenu statističnega znanja za soočanje s spremembami v okolju, izboljšanje ponudbe in dostopnosti formalnih in neformalnih oblik statističnega izobraževanja za vse generacije. Rezultati raziskave bodo prispevali tudi k boljšemu načrtovanju in izvajanju statističnega izobraževanja na ravni izobraževalnih institucij in učiteljev vseh treh generacij.

Ključne besede: okoljske spremembe, statistika, statistična pismenost, socialni akter, izobraževanje, generacije