



Use of Social Media to Improve Statistical Literacy

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ABSTRACT

An increasing problem with which statistical centers are facing is an unreasonable increase in survey nonresponse. Providing knowledge and statistical literacy could result in foundation of statistical culture to encounter with nonresponse problem. In purpose of increasing statistical literacy it is necessary to identify the non-specialists population and ways to inform them about main aspects of official statistics. Social media provide us a useful tool to access the people due to its high penetration coefficient rate. Different tools can be implied for distinct age groups, such as animated cartoons for children and youth, TV shows and advertisements for adults, including suitable contents proportional to the aimed age groups. Focus on raising the statistical knowledge of children is a longtime investment for developing statistical literacy among the next generations. In this paper we will aim to discuss about the suitable contents of the TV programs to develop statistical literacy.

Keywords: Statictival literacy, Social media

1. INTRODUCTION

The inability of many people to understand statistical concepts could affect both survey outcomes and public interpretation of results. In the first aspect lack of knowledge may results in providing unsuitable or incorrect information in regard to the survey questionnaire which lead to the measurement error. On the other hand, even in the ideal cases where all the respondents provide correct information, there is no guarantee that the survey outcomes are correctly interpreted by public. The latest one is due to lack of knowledge to understand what survey statistics mean, unfortunately people often not aware of their inability. Improving statistical literacy will result in promoting these two aspects. Enhancement of statistical literacy needs the cooperation of different actors in statistics including the educational institutes, national and international organization of statistics and statistical societies. These actors could reflect the current status of statistical literacy and what is expected to be, then they can make a plan and define the necessary approaches to achieve the desired level of statistical literacy in the future. A powerful tool to expose the statistical concepts for the public is media. Social media provide us a useful tool to access people due to its high penetration coefficient rate. Different tools can be implied for distinct age groups, such as animated cartoons for children and youth, TV shows and advertisements for adults, including suitable contents proportional to the aimed age groups. Focus on raising the statistical knowledge of children is a longtime investment for developing statistical literacy among the next generations.

In the next section statistical literacy is defined and its importance is mentioned briefly. In Section 2, we discuss about the usefulness of the media in providing statistical knowledge and its impact on promoting statistical literacy, the suitable contents of the TV programs to develop statistical literacy will mentioned as well. The paper is ended by conclusions and recommendations.

2. WHAT IS STATISTICAL LITERACY

Although it seems that statistical literacy is a trivial concept, there are several definitions and most of them are based on the definition given by Katherine K. Wallman (1993) in the speech she delivered when she became President of the American Statistical Association: “Statistical literacy is the ability to understand and critically evaluate statistical results that permeate our daily lives – coupled with the ability to appreciate the contributions that statistical thinking can make in public and private, professional and personal decisions”. Another point of view is the definition represented by Gal (2004) which describe statistical literacy as people’s ability to interpret and critically evaluate statistical information and data-related arguments to discuss or communicate their reactions to statistical information, such as their understanding of the meaning of the information, their opinions about the implications of this information, or their concerns regarding the acceptability of given conclusions. Achievement to this level of statistical literacy results in increasing awareness and improving the popular realization of statistics and maintains the legitimacy of statistics in the society.

Reaching the acceptable level of statistical literacy needs to cooperation of different actors in statistics including national and international statistical organizations, statistical societies and statistical education institutes. There are different aimed groups and there is hierarchical order for some of these groups to be mentioned. For instance improvement of statistical literacy of children through school curriculum require the engagement of the whole education community such as teachers, teacher educators, researchers and curriculum developers as well as academics and government (Unece, 2012). Advancement of statistical literacy of children is a long time investment because when they become familiar with statistical concepts and be able to statistical thinking and reasoning, they will be statistically literate in their adulthood and

may only need maintenance programs to stay updated. Investment on children yielded to have aware citizens in future, but on the other hand there are elderly people at the moment without enough statistical knowledge in spite of receiving statistical information during their lives. In this paper we focus on these two main groups, children and nonprofessional adults, the required content for them are substantially different. The high penetration coefficient rate of media provide a tool to access these people and teach them the statistical concepts directly or indirectly as well as give them the statistical information about the society. These information included the reliable statistical indicators of conditions and changes related to economic and social phenomena such as outcomes of census and surveys like migration rate, inflation rate, unemployment rate, infant mortality rate, etc. Generalization of results of many health and social researches are based on statistical concepts as well. The appropriate level of statistical literacy and access to the efficient and timely prepared statistical indicators enable users to understand circumstances of their society and even make decisions for their personal matters. Furthermore, there would be another aspect of statistical literacy of citizens which is beneficial for national statistical offices. If people find out that how their partnership and providing information in census and surveys results in more real statistics, they will be encourage to be better respondents.

Statistical Offices are responsible not only for producing, disseminating and analysing statistical information but also for ensuring that this information is understood as objectively as possible. Statistical offices should pay special attention to user support, statistical awareness and statistical literacy (Helenius & Mikkela, 2011).

3. IMPROVEMENT OF STATISTICAL LITERACY THROUGH MEDIA

Television form an important media widely used to disseminate information to its viewers. Combining audio and visual technology is a unique property of this mass media and serves multiple purposes of entertainment, information, and education. Many households “usually” have the TV on, even during meals. Bases on the Spending Time survey in Iran the youth between 15 to 24 years old ages, averagely spend two hours a day on mass media including TV. On the other hand the survey of Household Income and Expenditure in Iran demonstrate that around 98 and 95.5 percent of households have color TV in urban and rural areas respectively. Purcell-Gates (1996) proposes that the most influential cultural contexts impacting young children’s language and literacy learning are the home and community, with television and other screen-media increasingly forming a key part of these environments. It seems that TV is become an effective common member of each household which can be used to educate the society and form desirable culture. One of the main elements of literacy is statistical literacy which can be improved by suitable TV programs for different age groups. TV shows aimed at young children and adolescents are not only educational but also inspiring. We will discuss about the proper educational contents for child, youth and adults, it is worth to mention that the structure of the programs are assumed to be the same for child and youths and differences are considered in the contents. But, the programs for adults could be completely different. We mention the child program at first and then addressing the agendum for adolescent.

TV is one of the primary sources of entertainment for kids. The sounds and colorful images on the screen appeal to children and also retain their attention. From movies to cartoon shows, there are several programs to keep children engaged. Educational TV programs encourage children to try new things. Meta-analysis of over 30 years of research on the popular children’s program “Sesame Street¹” indicates that children can

¹ Sesame Street is an American educational children's television series that combines live action, sketch comedy, animation and puppetry.

learn various concepts and skills, including important language and literacy skills, from viewing educational television (Mares & Pan, 2013). In spite of this advantages, the skills such as language and social skills are developed during the first two years of a kid's life.

Experts recommend that children under two years of age should not be exposed to TV, as it can be ruin their cognitive, social and physical development, because Watching TV won't give them enough time to participate in activities which will help them in developing these skills. Further, children who are under the age of two won't get any educational benefit from TV. So, it is necessary to aim for children older than two years. In addition, the reviewed studies showed that watching television replaces more vigorous activities and there is a positive correlation between time spent watching television and being overweight or obese (Caroli et.al 2004). In result two main principle should be noticed in child's program:

- The content of the show must be appropriate for child's age.
- The program should have short duration. The longer they watch, the more the chances of them getting addicted.

The appropriate TV programmes for childs and juveniles would be animation, TV shows, and different kinds of television match. In order to teach statistical literacy to the children the content of the programmes should be cover all statistical concepts from basic to advanced. Overallly these concepts include definition of statistics, data description, probability, random variables, statistical distributions, sampling, confidence intervals, hypothesis tesing and comparison of different population. Learning statistics from basic concepts to advanced topics through examples and games by fun, enabling childs and juveniles to think statistically and inference about the statistical outcomes. In result they can undrestand the socail and economocal statistics in their adulthood.

The ability to count is the necessary material for defining statistics. In the first step, we have to teach a little child how to count. For instance counting his figures or any other attractive things around him such as the household members, toys, number of cornflakes or choclates eating every day, number of friends. After that statistics can be difined as the numbers we use to interpret reality and data are the statisticians raw material. In the next step to teach decreptive statistics it is better to have some actual data. As part of a TV show we can distribute some balls with different colors between children and request those who have balls in a same colur to stand in a line. Surprisingly we simply darw a bar chart. For older children we can measure their weights or heights as an actual data set to work with. To teach the pie chart we can use a round cake and proprtion of the cake allocated to each group is related to the number of persons in that group, for instance groups made by colour of the balls. These methods are usefull to teach other types of charts and the ideas could presented by animations and butifull songs as well. Calculation of descreptive statistics are impossible for little children but we can make sense of spreadness of data as concept of variance, concentration indexes are difficult to teach expt the mod. We do not expect child to calculate the average but it is possible to teach its concept by help of chocolate. We give different number of the same chocolate to each child and then ask them to count the number of their own chocolate, they find out that some childe have more chocalates. In the next step we encourage them to play a game to have the same amount of chocolate. The game is counting the total number of chocolates and childs, then we ask them to pick up the number of chocolates equal to the mean. There is no need to know the formula of division for children in this way.

After being familiar with descriptive statistics, the next concept is probability. Nothing in life is certain. In everything we do, we encounter chances of successful outcomes from weather forecasting in order to plan for a trip to make a critical decision in business or medicine. But for most of the people, probability is the formal study of the laws of chances. We can teach the basic concepts of probability to children by frequent tossing of coins or dices as a game. First of all we need to clear the concept of sample space and random experiment. A random experiment is the process of observing the outcome of a chance event. In an animation it can be shown that a child tossed a coin and encounter different results or in a TV show we can ask the children to toss their coins. We request them to guess what would be the result, in result they find out that it is clear that the result would be head or tail but it is impossible to claim which one would be the exact result and it represent the concept of random experiment as well as the sample space. We prefer to start the game with a coin and then replicate it using a dice due to smaller sample space of a coin in comparison to a dice. Then the experiment expanded in a way to use more coins, dices or combination of throwing coins and dices based on the age of the aimed group for teaching. For children under the age of school it is enough to talk about elementary outcomes but for older children we can talk about different combination of elementary outcomes. In the next step it is turn to talk about probability. When an experiment can be repeated, then probability of an event is the proportion of times the event occurs in the long run. Definitions of random experiment, sample space and probability have been defined and now we should show how these abstract ideas can help to make good decisions in the case of imperfect information, which is the ultimate goal of statistics. For example we can match some gifts to outcomes of sample space and request children to choose the favorite gift based on the probability of occurrence.

Random variable is another important concept. We can simply define it as outcome of a random experiment which is symbolized by a capital letter. For instance a child is selected randomly and his weight, height or age would be realizations of random variables. We don't aim to teach the advanced form of concepts, we just aim to create a general understanding of them. The advanced form need to be learned at school.

Finally we begin looking at the real business of statistics which is sampling, that save time and money of statistical organizations. To show the importance of sampling we can show a pile of different toys such as different dolls or cars and ask them to guess how many pink dolls are included for instance. Then write down their guess and after that select a sample and count that specific toy and estimate the total number, finally compare the estimation and real amount. It is worth to mention that it is necessary to know the sample size in advance. To teach the concept of unbiasedness the sampling procedure could be replicated, it can be done by different child as a game and talk about the concept of randomization during the game. To clarify the importance of sample size, the game can be replicated from small to large sample sizes. It is expected that small sample size are not working properly and large sample sizes are not required and just make more difficulty. In order to teach the concept and necessity of stratified sampling, we could combine the cars and dolls and try to estimate the number of pink dolls and black cars for instance. Now we expect children to understand the concept of sampling, its time to teach the measurement error concept.

In order to teach the measurement error concept together with filling the questionnaire in sampling surveys we can make a scenario either for those who where predented in studio or watch the show at home. We select a sample of children from those who were presented in the studio and ask them about different things such as their name, age, favorite color among the list of colors, favorite animation or toy, weight, etc. ,the questionnaire should be short and contain amaizing

pictures or any other attractive things. The same questionnaire would be available through the programme website for attractive watchers. To understand the concept of measurement error, a spectrum of the child's favorite color is shown to him and ask him to determine which one he likes most. How can we use this method? Finally we conclude that yellow is the favorite color of five children but show them there are different yellows. For older children who know their height and weight, we can ask them about that and then measure it. In conclusion we show that there would be slightly different between the reported and measured values. From those who can not report their height and weight, we demonstrate that there would be missing values in surveys. Parents are get involved in learning statistics indirectly due to accompany their child's in watching TV.

Generally we can announce specific subjects, which could be every of the above material, and ask children to send writings or drawings to us as producers of programmes and dedicate some gifts for the best one. If we put enough effort and time to play statistical games such as the things mentioned above, we expect children to understand basic statistical concepts and be keen to know more statistics.

On the other hand, another goal is to improve statistical literacy among nonprofessional adults. The high penetration coefficient rate of media provide a tool to access these people and teach them the statistical concepts directly or indirectly as well as give them the statistical information about the society. In order to promote statistical literacy of adults via TV programmes we can focus on documentary programs and short lessons between commercials. In documentary programmes we can show the structure of the national statistical organizations, the necessity of existence and their goals, plans and outcomes. The international statistical organizations can also be subject of the documentaries. We can show existence of different kinds of census and surveys and their results can be presented by infographic. The basic concepts such as definition of inflation rate, economic growth, consumer price index, population growth rate, unemployment rate, economic participation rate, total value of imports or export, gini coefficient, life expectancy at birth can be teach in short TV shows. It's better to broadcast these TV shows like commercials in the middle of the most popular TV. Function of the short TV shows are only make people familiar with the definition of the most important indexes and stimulating their curiosity about statistical concepts, it would be amazing to ask people their ideas and knowledge about statistical literacy and the former mentioned indexes. In this way we can make sense of the overall level of statistical literacy in our society. We can talk about the indexes in more detailed programmes and clarify the definitions, the sources of definitions, the sources of required data and the most important thing is interpretation of the indexes by professionals. We can hold live competitions and ask people to interpret the statistics, in result we find out the bugs in understanding of citizens about actual concepts. We can also request people to send their questions and doubts about statistics or any other related thing to official statistics, which give us a guide about the topics for future TV shows.

CONCLUSION

Statistical literacy is an important issue which has been mentioned increasingly recently. Social media can be used by National Statistical Organizations due to high penetration coefficient rate in

order to share the statistical concepts to improve statistical literacy. In order to reach the aim of promoting statistical literacy, the programs must be carefully selected because there are distinct concepts need to be learned by different age groups. Focus on raising the statistical knowledge of children is a longtime investment for developing statistical literacy among the next generations. In result, it is necessary for the kids to learn basic to advance statistical concepts step by step. But for adults, is sufficient to learn the concepts which are used by NSOs. It is expected that reduction in survey measurement error will be occur by promoting statistical literacy due to having aware respondents.

REFERENCES

1. Caroli, M., Argentieri, L., Cardone, M., and Masi, A. (2004). Role of television in childhood obesity prevention. *International Journal of Obesity*, **28**, S104.
2. Gal, I. (2004). Statistical literacy: Meanings, components, responsibilities. In J. B. Garfield & D. Ben-Zvi (Eds.), *The challenge of developing statistical literacy, reasoning and thinking* (pp. 47–78). Dordrecht: Kluwer.
3. Helenius, R. and H. Mikkilä (2011). Statistical literacy and awareness as strategic success factors of a national statistical office – the case of Statistics Finland, *Statistical Journal of the IAOS*, *27*, 137-144
4. Mares, M. L., and Pan, Z. (2013). Effects of Sesame Street: A meta-analysis of children's learning in 15 countries. *Journal of Applied Developmental Psychology*, *34*, 140-151.
5. Purcell-Gates, V. (1996). Stories, coupons, and the TV Guide: Relationships between home literacy experiences and emergent literacy knowledge. *Reading research quarterly*, *31*, 406-428.
6. UNECE (2012). Making data meaningful: A guide to improving statistical literacy. United Nations: Geneva, Switzerland. <http://tinyurl.com/Making-Data-Meaningful-UNECE>
7. Wallman, K.K. (1993): Enhancing Statistical Literacy: Enriching Our Society. *JASA*, **88**, 1–8.