

## PROMOTING STATISTICAL LITERACY AMONG STUDENTS

### PROMOTING STATISTICAL LITERACY AMONG STUDENTS

CHAN, Vivian Wing-yan

Census and Statistics Department  
Hong Kong Special Administrative Region Government  
Hong Kong  
China

Contact email: vwychan@censtatd.gov.hk

#### ABSTRACT

*In this knowledge-based era, plenty of decisions which have a possible impact on people and the environment are backed by statistical considerations. The Census and Statistics Department (C&SD), as the central statistical office in Hong Kong, has been playing an active role in promoting proper and effective application and interpretation of statistics among students, the future pillars of our society. Over all these years, C&SD has been adopting a variety of means to reach out to students with a view to equipping our future generation with the necessary statistical knowledge and skills in this increasingly data-centric world. In particular, continuous efforts have been made to foster statistical education, including : facilitating easy access of official statistics; organising talks and visits for students; and collaborating with the local statistical community. This paper will discuss in detail how C&SD promotes and enhances statistical literacy of students in Hong Kong.*

#### THE KNOWLEDGE-BASED ERA

Shifting to the new paradigm of a knowledge-based economy, more people are looking to statistics to make logical reasoning and informed, evidence-based decisions in order to meet many of the socio-economic challenges. Governments need statistics for programme planning, administration and policy formulation. Investors and businessmen rely on statistical information in project planning and decision-making. The general public requires statistics to better understand social and economic developments and evaluate government policies and actions.

To this end, official statistics agencies inevitably play important roles in promoting the use and proper application of statistics.

#### DEFINITION OF STATISTICAL LITERACY

Statistics can tell us about the world we live in and things happening around us in a scientific and objective manner. Statistics helps exploit facts, trends and relationships behind data. Understanding statistics encountered in everyday life, from the media to the workplace, is as much a basic skill as reading. This helps people make sense of a complex world.

When it comes to “statistical literacy”, the term has yet to be clearly defined.

According to Milo Schield, “numeracy focuses primarily on numbers while statistical literacy focuses more on the words framing the numbers” (2004, p.1) and “statistical literacy is typically more about words than numbers; more about evidence than about formulas” (2004, p.9). Watson and Kelly (2003) also highlight this point : “Statistics requires the basic understanding of statistical concepts ..... whereas literacy requires the ability to express that understanding in words, not in mathematical formulas”.

Steen also writes about this interconnectedness between words and numerical information : “Literacy is no longer just a matter of words, sentences and paragraphs, but also of data, measurements, graphs and inferences” (1997, p. xxvii).

Learning to calculate should be balanced with learning to interpret and critique.

Wallman (1993) refers to statistical literacy as the ability to understand and to be critically aware of statistical information, and to appreciate the importance of statistical reasoning for decision-making in working and private life. Rumsey (2002) gives an overview on different definitions and presents a slightly more extensive concept. She explicitly distinguishes between “statistical competence” or good “statistical citizenship” on the one hand, and skills for carrying out basic statistical research on the other hand. The first level of statistical literacy in Rumsey’s definition approximately covers the definition of Wallman and refers to understanding and applying basic statistical concepts properly. Rumsey’s second level is built on the first level and addresses the ability to inquire, to probe, to base sound decisions on data and to comprehensibly communicate data-based decisions.

While the definitions of “statistical literacy” are multifarious, the ultimate goal of promoting statistical literacy is almost universal – to orientate individuals towards : (a) possessing a basic understanding of statistical concepts and methods; (b) identifying correct statistics from the pool of accessible statistical data; (c) making proper use of relevant statistical data to understand facts and phenomena; and (d) analysing issues, making decisions and planning future actions with proper statistics. In essence, the promotion of statistical literacy deals with the issues of how to equip people with skills of turning statistical data into information and knowledge and of applying statistics in their daily endeavours.

#### STATISTICAL LITERACY – STUDENTS AS IMPORTANT STAKEHOLDERS

In today’s knowledge- and information-driven societies, being a good “statistical citizen” should be recognised. Statistical literacy, which embraces a critical set of skills, should be addressed if our citizens, in particular our future generations, are to become informed members of the community, as “statistical information needs to be communicated in an effective manner that can impact upon decision making” (Watson, 2005). Part of being statistically literate is the ability to discuss personal understanding of data, reactions to data and concerns over conclusions (Gal, 2002). This relates not only to statistical terms but also to the appropriate expression of information. It includes the ability to organise and manage data sets, report data appropriately and question how data is reported.

Knowledge and skills of how to use and communicate statistics are therefore necessary in this modern world packed with information and data. Statistical literate people should be armed with the skills essential to understand and interpret data as part of the process in weighing risks and rewards to make decisions in the presence of uncertainties.

Promotion of statistical literacy entails careful consideration of the characteristics and specific needs of different sectors in the community. Thus, official statistics agencies may find it more effective for the related activities to be target-oriented.

The majority of students are young people. They will play a crucial role in shaping the future of our world. It is important to impart the benefits of statistical literacy on students, who are the future pillars of society. In promoting statistical literacy of students, it is deemed necessary for an official statistics agency to forge partnership with educational authorities/institutions for setting up a platform in achieving this, say, by (a) providing relevant materials for supplementing formal statistical education at schools; (b) providing assistance for statistically-related extra-curricular activities; and (c) facilitating easy access of official statistics to students in their studies and project work.

By creating a statistically friendly environment for students, they will gradually get accustomed to using official statistics to deal with their daily endeavours, which will in turn help them build up a good foundation of proper use of statistical methods and data. As educational institutions, in particular secondary schools, are effective channels for reaching students, they are ideal partners on the promotion of statistical literacy.

#### PROMOTING STATISTICAL LITERACY AMONG STUDENTS – HONG KONG, CHINA

As the central statistical office of Hong Kong, C&SD has been sparing no efforts to develop and open up new frontiers, with an aim of providing adequate, relevant, reliable and timely statistics for meeting the increasingly diversified data needs of the Government and

various sectors of the community.

C&SD is also mindful of the need in cultivating a statistical environment. In this regard, C&SD takes an active interest in promoting statistical literacy among people in various sectors of the community (e.g. secondary students, secondary school teachers, tertiary students, government officers, media workers, members of the public), and achieves the objective through both advocacy and implementation of programmes and activities.

Of the various promotional activities, those targeting students are at the top of the priority list. Apart from instilling an awareness and better understanding of statistics in the students, these activities aim to help them establish a good foundation of proper use of statistical methods and data. This will in turn enable them to appreciate the multi-faceted application of statistics in discerning the complexities and cross-disciplinary nature of real life issues and sharpen their ability to connect, integrate and analyse statistics in everyday life.

### *FACILITATING THE TEACHING OF STATISTICS AT SCHOOL*

Like many places in the world, “Statistics” is not a stand-alone subject in the secondary school curriculum of Hong Kong. It is usually subsumed in Mathematics and Liberal Studies.

In Mathematics, the topics relating to statistics mainly cover statistical and numerical data processing techniques, including, for examples, measures of central tendency, measures of dispersion, probability, as well as use and misuse of statistics.

Liberal Studies is among one of four core subjects (with the other three being Chinese Language, English Language and Mathematics) under the secondary school curriculum of Hong Kong. Its key objective is to enhance students’ social awareness and to encourage them to inquire into different social topics of interest. These cover a wide range of contemporary issues relevant to daily lives, such as self and personal development, society and culture, and science, technology and the environment. Students need to make connections across different fields of knowledge and concepts, and learn to examine issues from multi-perspectives, thus fostering their capacity for making independent analysis as well as developing their critical mind. They are required to carry out an “Independent Enquiry Study” on a topic selected according to their interests. They have to collect and organise relevant information and data, make appropriate analysis, and prepare a report to present the study results. The curriculum design demonstrates the high relevance of statistical information to different facets of our lives, bearing out the importance of data analysis skills. The curriculum embraces knowledge of various subjects with economic and social perspectives, drawing on social and economic statistical indicators as the key measurements. To students, it is extremely useful to make use of the key statistical indicators compiled by C&SD, which are readily accessible on the C&SD website. The integration of a curriculum with official statistics is conducive to the promotion of statistical literacy among students. This highlights the importance of establishing a platform with educational institutions in taking forward statistical education.

As an initiative to facilitate the teaching of statistics, C&SD compiled a teaching kit entitled “Living with Statistics” in 1990 with subsequent updates thereafter. The teaching kit mainly aims at providing secondary school teachers and students with a convenient means of accessing reference materials on commonly used statistical methods and official statistics in Hong Kong. It also touches upon possible pitfalls that should be avoided in using statistics. Taking advantage of the widespread usage of the Internet and mobile devices, the teaching kit has been released online since 2012.

Teachers of different subjects can draw on materials provided in this kit flexibly in supplementing their teaching with statistics/statistical methods relevant to any particular subjects. The kit may, of course, also be used as an independent statistical teaching package to expand the exposure of secondary students to official statistics as well as proper statistical methods.

As teachers play an important part in the promotion of statistical literacy of secondary students, C&SD collaborates with the tertiary educational institutions and the Education Bureau to arrange short courses and seminars to enhance their statistical knowledge so that they can deploy statistics in their teaching more readily.

With a better understanding of official statistics and proper statistical methods, students

will be able to enhance their awareness and appreciation of statistical information that is needed to comprehend and interpret social and economic phenomena, particularly in relation to Hong Kong, more systematically. They will also be able to apply statistics in their daily endeavours in a proper manner.

## PURSUING E-INITIATIVES IN THE PROMOTION OF STATISTICAL LITERACY AMONG STUDENTS

Driven by the changing technological environment and service needs, many official statistical agencies have started adopting a data dissemination strategy of an open and free access to statistical information by providing their products available online over the past decade. This development has presented a window of opportunity not only to attain greater transparency as a trusted agent but also to become a key contributor to statistical literacy.

Leveraging on the increasing Internet penetration rate, C&SD has been making continuous efforts in enriching the contents and functionality of its website for further enhancing the understanding and application of official statistics in the community. For instance, a mobile version of the C&SD website has also been introduced to facilitate navigation of the latest Hong Kong statistics on handheld devices.

Students are encouraged to access the C&SD website for up-to-date social and economic statistics. They may also refer to the section on “Statistical Literacy and Students’ Corner” for understanding more about official statistics and proper application through short statistical articles as well as educational booklets/leaflets. Statistical hyperlinks are provided between various educational websites and the C&SD website to facilitate students’ easy access to statistics.

It seems to be indisputable that e-learning and visual data communications play an increasingly important role in addressing the needs of non-professional customers, in particular the young lay public, in this modern information technology era. C&SD has adopted a modern dissemination strategy to present commonly used statistics in the form of “Interactive Statistics” via a user-friendly dashboard design. Through simple graphical interface, thematic maps and interactive charts, users can better grasp the characteristics of Hong Kong’s population, households, business establishments and persons engaged in the establishments. In addition, users can compile their own tables through the “Interactive Data Dissemination Service”, which supports chart drawing for the output statistical tables.

In commemoration of its 45<sup>th</sup> anniversary in 2012, C&SD launched a web-based exhibition on its website. The web-based exhibition highlighted the major events and accomplishments in the history of C&SD. The statistical graphs and charts presented in the exhibition well illustrated Hong Kong’s social, economic and financial developments over time. Also included in the exhibition was an index series of statistical feature articles published in the *Hong Kong Monthly Digest of Statistics* since 1971. Relevant web-links were provided to facilitate direct access to the individual feature articles. Showcasing the different facets and changes of Hong Kong over time, these feature articles were educational in nature and provided important references for understanding the developments of Hong Kong from a statistical perspective.

### *Talks, Visits And Exhibitions For Students*

C&SD has put in place a programme of statistical talks for secondary school students since the academic year of 1993-1994. These talks, delivered by professional statistical staff, introduce commonly used statistical methods and data, covering such areas as population statistics, employment and unemployment statistics, external trade statistics, price statistics, national income statistics and balance of payments statistics. The talks help students learn more about statistics and develop interest in the subject at school. This may in turn promote applications of statistics in a correct way in their work and daily lives later on. The programme has been well received by both schools and students and the demand for the talks has been on the increase over the years.

Talks pitched at a more advanced level are organised for tertiary institution students. The

major topics of the talks include: sampling design of the C&SD's surveys; methodologies of C&SD's seasonally-adjusted data series; projection and forecasting methods; and use of sectoral economic statistics in business applications.

In the 59<sup>th</sup> World Statistics Congress (WSC) to be hosted by C&SD from 25 August to 30 August 2013, "Youth" will be specially chosen as the main theme for encouraging more young statistical practitioners to participate in the event. To tie in with this theme and with the support of funding from various sources, C&SD has put in place a programme to sponsor local young university students in statistics or related fields for the WSC's full registration fee. Through attending the 59<sup>th</sup> WSC, they will be able to strengthen statistical knowledge, enhance understanding of the crucial role played by statistics in socio-economic issues, and, more importantly, broaden exposure and personal network locally and internationally.

Apart from statistical talks, students' visits to C&SD are also organised from time to time. A typical visit comprises a briefing session and a guided tour around the office premises. The briefing session usually covers an introduction to the organisation and work of C&SD, commonly used official statistics in Hong Kong as well as career opportunities in C&SD. The briefing session is followed by a guided tour to such locations as the Service Centre on Trade Statistics and Publications Sales Centre of C&SD. Through these visits, students can acquire a first-hand perspective of the work of the Department, which may in turn help foster an interest in statistical work.

C&SD also participates in the civil service career talks and exhibitions held at various universities and tertiary educational institutions. This aside, C&SD has been collaborating with local universities in launching the Professional Attachment Programme for their students from the statistics or related departments. The Programme provides students with practical experience in official statistical work, helps motivate potential candidates to join the statistical careers in C&SD, and offers opportunities to publicise the work of C&SD among students who may be users of official statistics and data suppliers in their future careers.

#### EDUCATIONAL MATERIALS FOR STUDENTS

An important aspect of being "statistical literate" hinges upon data awareness, namely, an awareness of data sources, data availability, data accessibility and data applicability, when making or examining statistical claims. Students are encouraged to link real-world examples with the relevance of statistical thinking in picking up statistical knowledge and application. In this regard, C&SD has been publishing statistical feature articles in the *Hong Kong Monthly Digest of Statistics* since 1971. Such articles, ranging from brief overviews of administrative data and survey findings to detailed analyses of social, economic and financial statistics, serves useful materials for students in learning statistics. All these articles are available on the C&SD website to facilitate easy access by students.

#### STATISTICAL PROJECT COMPETITION FOR SECONDARY SCHOOL STUDENTS

Over all these years, C&SD has been collaborating with the Hong Kong Statistical Society (HKSS) in enhancing statistical literacy and promoting application of statistics. Among others, C&SD has been providing keen support to the Statistical Project Competition for Secondary School Students, an annual HKSS event since its launch in 1986.

The declared purpose of the Competition is to encourage students to gain a good understanding of the community through the use of statistics. Participants of the Competition are required to conduct a project on a topic relating to the social or economic situations of Hong Kong. They need to demonstrate their ability of simple statistical analyses and reasoning on the basis of available official statistics. It is encouraging to see an increasing number in entry projects, a more variety of topic coverage and an improvement in the overall quality recent years. Through participating in the Competition, students will be able to learn how to understand the community in an objective manner through proper use of scientific methods and statistical data. The Competition also provides a valuable opportunity for participants to put statistical theories from textbooks into practices and foster the cross-fertilisation between statistics and other subjects.

## CONCLUDING REMARKS

In this modern world, statistics play an important role in economic, social and scientific spheres. Statistical literacy has been gaining ground over the years. Being the future generation of our community, students need to acquire knowledge statistics and its applications to prepare for their future careers as well as being able to make more rational decisions in daily endeavours. Official statistical agencies can play a pivotal role in the education on statistics among students, partnering with either statistical organisations or schools, or both, in spreading statistics knowledge and applications. The experience of C&SD has proved to be workable in enhancing statistical literacy of students. Among others, C&SD actively creates a statistically friendly environment for students, provides useful materials for teachers to teach statistics at schools, organises statistical talks for students and promotes students' statistical projects.

The participation of official statistical agencies in promoting statistical literacy helps foster better statistical education, which is a good cause in itself. In addition, this contributes to the use of official statistics in the community, which also should be a laudable goal of official statistical agencies around the globe.

## REFERENCES

- Whitin D.J. and Whitin P. (2011). Integrating Critical Numeracy and Critical Literacy in K-8 Classrooms. 2011 Joint Statistical Meetings (JSM), Florida, U.S.A.
- Mittag, H.J. (2010). Promoting Statistical Literacy : A European Pilot Project to Bring Official Statistics into University and Secondary School Classrooms. 8<sup>th</sup> International Conference on Teaching Statistics, Ljubljana, Slovenia 2010.
- The Australian Bureau of Statistics (ABS) Education Services (2007). Statistical Literacy.
- Harraway, J.A. (2009). Learning statistics in the senior school using illustrated real data in context. IASE/ISI Satellite, Durban, South Africa 2009.
- Gibson, L., Marriott, J., & Davies, N. (2007). Solving the problem of teaching statistics? ISI 56<sup>th</sup> session, Lisboa, Portugal 2007.
- Ho, F.W.H. (2005). The role of official statistics agencies in the promotion of statistical literacy among students. ISI 55<sup>th</sup> session, Sydney, Australia 2005.