EDUCATIONAL USES OF YOUTH STATISTICS FOR THE REVISED TERTIARY GENERAL EDUCATION CURRICULUM IN THE PHILIPPINES

RESTON[1], Enriquet & JALA, Liza Lorena[2]

[1]University of San Carlos, Philippines
[2]University of Cebu, Philippines

Contact email: edreston@usc.edu.ph

ABSTRACT
In this paper, we present some educational uses of youth statistics for a General Elective statistics course that applies a cross-disciplinary perspective to meet the goals of the Revised General Education curriculum in the Philippines. Youth statistics generated by official statistical agencies in the country and from various national and international surveys about the youth are used to provide the database to anchor the teaching of statistical concepts and methods. Using anchored instruction and a thematic approach, statistical concepts and methods are introduced through integration of multiple data sets on youth statistics from various interdisciplinary perspectives of the social sciences. The materials and activities incorporate features of constructivist teaching and learning, using inductive and active learning approaches to support successful statistics learning for college students.

Keywords: Youth statistics, Statistics Education, General Education curriculum

BACKGROUND

Over the past two decades, a number of curriculum development projects have been presented to address the need for reform in teaching statistics in order to achieve the overall goal of promoting and developing statistical literacy among different groups of students. Verschut, & Bakker (2010), for instance, described a new statistics curriculum that had been proposed for senior general secondary education in Netherlands that focused on learning statistics by a data-based and problem-oriented approach. In this new curriculum to be implemented in 2014, teachers are encouraged to let students work with real data sets and information technology. In order to achieve coherence in the intended curriculum, the recommendations are the following: (1) Build around central themes; (2) Emphasize the purpose, and (3) Make relationships between chance and data explicit.

Recently, the goals of statistics education placed increasing emphasis on empowering citizens from all walks of life to function effectively in an information-laden society (European Commission, 1996; cited in Murray & Gal, 2002). It is recognized that statistical information produced by an increasing number of public agencies and private organizations play a vital role in enabling citizens to develop awareness and capability to react intelligently to various social, political, economic, phenomena. Information needs of different population groups and target audiences is pointed out by Murray and Gal (2002) as one of four issues that need to be considered in order for data producers, statistical reporters and educators to be effective in transmitting informative messages. In this connection, the role of National Statistics Offices (NSOs) and other data producers is recognized in statistics education at both school and university levels.

In the Philippines, recent significant developments in the Philippine Educational System, primarily the launching of the K *to 12* Basic Education reform by the Department of Education and the College Readiness Standards issued by the Commission on Higher Education (CHED), has led to the revision of the General Education Program for tertiary education. With the goals of developing holistic understandings, intellectual and civic competencies, the CHED technical panel on General Education (2012) has drafted a revised General Education curriculum with 24 units of core courses and nine units of elective courses. Among these eight core courses is a three-unit mathematics course entitled *Mathematics in the Modern World*. Statistics as a discipline in its own right is not among these core courses; statistical concepts and methods are expected to be

integrated in this 3-unit Mathematics course. The next section describes an approach intended to deal with this limitation.

THE PROBLEM

The revision of the General Education curriculum at the tertiary level poses several challenges to the teaching of statistics and the important role it plays in the development of a statistically literate citizenry. With the reduction of the general education courses from between 54 to 60 units into 36 units comprising 8 core courses and some electives, statistics is no longer a stand-alone course but will be integrated in mathematics. We find this inadequate for students to develop the much-needed statistical literacy skills for effective functioning in an evidence-based society in this Information Age. Thus we propose a curriculum for general education elective course for non-statistics majors using youth statistics generated by official statistical agencies and from various national and international surveys as the database to anchor the teaching of statistical concepts and methods.

This paper explores the educational uses of youth statistics in a proposed General Education course we developed for college students. In response to the need for a relevant statistics education in line with CHED's Revised General Education Curriculum standards, this paper seeks to answer the following questions:

1. How may a college statistics course be designed as a general education elective in line with the standards for the revised General Education curriculum?
2. What youth statistics may be used to provide a real, contextual data-based platform for teaching statistical concepts and methods for students in this General Education statistics course?
3. What specific course activities using youth statistics may be designed that address both the goal of developing statistical literacy and goals of the Revised General Education curriculum?

PREVIOUS EFFORTS

In the Philippines, Reston and Bersales (2011) examined some reform efforts in the teaching of statistics at the secondary and tertiary levels. They find that institutional efforts towards statistical capacity building are primarily done through the Philippine Statistical System (PSS) and the Philippine Statistical Association (PSA). In the PSS, the main agency that is involved in statistical capacity building is the Statistical Research and Training Center (SRTC), its training and research arm. These reform efforts include instructional materials development and training of teachers. SRTC sponsored the writing of reference materials for teaching statistics in the different levels of the educational system. For the training of college statistics teachers, SRTC forged in 2006 a partnership with selected higher academic institutions all over the country and provided the training of the faculty of these institutions as training affiliates of SRTC (Reston and Bersales, 2011). On the other hand, the PSA is the nationwide professional association of statisticians in the Philippines and it is a staunch advocate of proper instruction of statistics in the educational system as well as appropriate methodologies of data collection, generation of statistics, analysis and interpretation of data by the government and the private sector. Two major activities of the association over the past decade focused on statistics education, particularly on teacher training and the review and provision of locally available textbooks as references (PSA Report, 2007). Aside from these institutional efforts, data provided by academic institutions on statistics teacher training have shown that these colleges and universities have tapped each other's faculty members as resource persons in trainings conducted for statistics teachers. Aside from teacher training, other activities done to improve statistics instruction include the writing of training modules, textbooks and other reference materials, and the conduct of colloquia, symposia, and conferences (Reston & Bersales, 2011)

At the level of individual statistics educators, we find very few documented sources on these reform efforts. Among these is the study of Prado and Gravaso (2011) on improving high school students' statistical reasoning skills through the use of Anchored Instruction. The study describes the design, implementation and evaluation of a learning resource unit called "Mark's Eco-Encounter" on Binomial, Poisson and Normal Distributions. It applied a low-cost media mix

composed of a video presentation, a teacher's guide and answer sheets. The results revealed that students in Anchored Instruction showed significant learning improvement in problem solving skills ($p<0.01$). In terms of learning experiences, students feedback though focus group discussions (FGD) revealed that they find the learning unit as interesting, motivating and situated in realistic situation. Further, the anchored instruction method based on the learning unit allowed collaboration among students including learning beyond statistics, provided "episodic memory cues" and promoted a positive change in students' perception of statistics.

COURSE DEVELOPMENT

The revised General Education (GE) curriculum covers the basic knowledge domains in the core courses and provides some element of choice through the elective courses giving Higher Education Institutions (HEIs) some level of autonomy to design part of their GE curriculum (Commission on Higher Education, 2012). We take this provision as an opportunity to assert the importance of statistics education as a stand-alone course in the GE curriculum aside from the stipulated integration with mathematics in the core courses. Further, the Commission on Higher Education (2012) stipulated that to qualify as a GE elective, the course must (1) conform to the philosophy and goals of General Education; (2) apply an inter- or cross-disciplinary perspective; and (3) draw materials, cases or examples from Philippine realities and experiences, and not just from those of other countries. It is in this context that this proposed statistics course is developed as a GE elective.

Course development of this proposed statistics GE elective takes into consideration the goals of the revised GE curriculum towards the development of holistic understandings, intellectual and civic competencies and the overarching goal of statistics education which, in broad terms, is the development of statistical literacy. Further, the primary purpose of the revised GE which is "the holistic development of the person, conscious of her/his identity as an individual, a Filipino, and a member of the global community," (Commission on Higher Education, p. 2). Towards this end, we deem the use of youth statistics as a relevant data-based platform through which statistical concepts and methods will be taught.

In particular, this paper explores the educational uses of youth statistics in a proposed general education statistics course. The course description and objectives are as follows.

Course Description:

This course is intended as a general education elective for college students. Its overarching goal is the development of statistical literacy among college students, a real life skill needed for the development of holistic understandings, intellectual and civic competencies for effective citizenship in this information-based society. Through anchored instruction using youth sector statistics, statistical concepts and methods are introduced by integrating multiple data sets on youth statistics from various interdisciplinary perspectives of the social sciences.

Course Objectives:

Given the learning materials and activities of this course, students will:

1. demonstrate relevant statistical knowledge and skills in making sense with data through various forms of data presentation, organization and analysis with the aid of technology.
2. formulate and investigate relevant research questions on the youth sector population using sound statistical principles and methods
3. develop more holistic understanding and appreciations of the youth population in line with the goals of the Revised General Education curriculum .

Course Implementation

The course will be divided into two modules and will be delivered using inductive teaching and learning approaches. These approaches encompass a range of teaching methods where instruction begins with a scenario - a set of observations or data set to interpret, a case study to analyze, or a real data-based problem to solve instead of beginning with general theories and principles, and eventually getting to applications. Specific methods that are considered as inductive include inquiry learning, problem-based learning, project-based learning, case-based

teaching, discovery learning and just-in-time teaching. They are all characterized as learner-centered, constructivist and active learning methods (Prince and Felder, 2006).

EDUCATIONAL USES OF YOUTH STATISTICS AND SAMPLE CLASS ACTIVITIES

In this section, we identify some educational uses of youth statistics and present sample teaching-learning activities, anchored on relevant statistical concepts and methods, for meaningful interaction with empirical data pertinent to the youth sector. These statistics include data on the socio-demographic structure of the youth sector of the Philippine population, their health and general well-being, education, employment, organizational involvement, and participation on civic activities as well as in undesirable activities like smoking and drinking, criminality and illegal drug use, among others.

1.0 Youth Statistics as a data-base for building conceptual understanding of big statistical concepts

In this context, youth statistics arising from results of surveys on the youth sector of the population will be used to provide the data-base through which students build and strengthen various statistical concepts and methods. In Course Module 1: *Understanding the Filipino Youth through Descriptive Statistics*, students will explore the results of surveys pertaining to the youth sector such as the *Survey on Children* done by the National Statistics Office and the *Situation of the Filipino Youth* by the Social Weather Station, and surveys by Pulse Asia and other leading pollsters of the country. With these various data sets, students will make sense of tables and graphs, and build conceptual understanding of big statistical ideas such as data and measurement, variables, populations and samples, variation and randomness. Moreover, they will describe the data in terms of location and variability and further explain how statistics may be used and misused. Sample activities in this module include the following:

Activity 1. Making Sense with Tables

In this activity, the students will examine various data sets in table format, and they will identify the types of data and variables and their levels of measurement. Using descriptive statistical measures, they will describe and interpret the distribution according to some pertinent variables. One sample table is the distribution of children ages 5 to 17 years old by sex, age group, region from which they come and their employment status, whether they are working or not working (NSO Survey on Children, 2012). From the data in the table, students will write an interpretation and a reflection on the real world phenomenon represented by the data.

Activity 2. Making Sense with Graphs

Students will explore various types of graphs such as a line graph showing the Labor Force Participation of the Filipino youth compared to the Southeast-Asia and the Pacific and the world (Philippines 2011, Youth Education). They are expected to describe and interpret the data shown on the graphs by comparison and analysis. Students will also be exposed to good and not – so-good models of graphs, and they will evaluate these graphs and comment on how the information may be twisted by using inappropriate graphs.

2.0 Youth Statistics as the Tool for Inquiry and Statistical Investigations

Youth statistics will also be used as tools to provide the context for inquiry and statistical investigations, illustrated in Course Module 2*: Celebrating our Commonalities and Differences through Inferential Statistics.* In this module, youth statistics will be used as springboard for students to pose questions for investigations, such as how samples were drawn, how results will be affected if randomized or non-randomized sampling were used, and how generalizations on relationships between variables and comparisons between groups can be made. Sample activities in this module include the following:

Activity 1. Understanding Sample Size and Sample Representativeness

Students will be given the Preliminary Results of the 2011 Survey on Children (NSO 2012*).* Then doing a Think-Pair-Share activity by groups of three, students will pose questions on the sampling technique used and make judgments on whether the sample size is adequate or is representative of the population. Students will present the results of their group discussion, and the teacher will facilitate and correct possible misconceptions on sample size and sample representativeness.

Activity 2. Understanding Estimation of Parameters

Using the paper on "The Situation of the Filipino Youth: A National Survey" done by the Social Weather Stations (SWS) led by Mangahas, Sandoval and Guerrero (1996) as commissioned by the National Youth Commission, students will pose questions for analysis on the representativeness of the 1, 200 respondents drawn from the 15-30 years old population, for an error margin of ±3% at a 95% confidence level. To develop understanding on the process of parameter estimation, students will be grouped into three's and discuss among themselves how this error margin of ±3% and the 95% confidence level would affect the interpretation of the data found in tables such as one showing the distribution of the respondents by gender who smoke and drink. After the student's sharing and presentation, the teacher will address misconceptions if there are any and strengthen conceptions as well.

Activity 3. Understanding Hypothesis Testing

Given data on "Youth Unemployment Rates by Gender" (Philippines 2011, Youth Education) for four consecutive years (2006-2009), students will pose questions on comparison of rates between two given years and investigate in which year the proportion of female and male who are unemployed seems to be statistically significantly different. Simulations may also be used to see if the observed data is due to chance. When they find significant difference in proportion, they will do research on the economic situation of the country and the world as a whole and draw implications on these differences.

3.0 Youth Statistics as the Context for Developing Holistic Understandings, Intellectual and Civic Competencies

In line with the goals of general education on development of holistic understandings, intellectual and civic competencies, the use of youth statistics will provide the relevant context in the development of self understanding and national consciousness among students as members of the youth sector. By identifying themselves as among the youth, they may be empowered to make use of data-based characterization of their national identity and their role in the society, the nation and the global community in general. As part of Course Module 2. *Celebrating our Commonalities and Differences through Inferential Statistics,* the activity below will illustrate the use of youth statistics in this context.

Activity 4. Creating a Picture of the Filipino Youth Through a Survey

This is a culminating course activity whereby students in groups of 3 or 4 members will identify a topic of general interest about the Filipino youth population, pose relevant research questions, review related literature, draw hypotheses and conduct a survey to gather youth statistics to test their hypothesis. The teacher will facilitate the process of research problem conceptualization and selection of variables to be included in the survey. By applying the different statistical principles, concepts and methods learned, students will develop a research paper that creates a picture or tells a story about some phenomena of interest about the Filipino youth. Through this activity, students will demonstrate holistic understandings of the statistical and research process and about a particular dimension of the youth sector being studied.

All of these activities will use rubrics as a scoring guide for the teachers and the students as well. Through the rubrics, the students will understand what and how much is expected of them and by what criteria their work will be evaluated.

CONCLUSIONS

The use of youth statistics data-sets from NSO and private organizations' surveys will provide a rich ground for approaching the teaching and learning of statistics from a cross-disciplinary social science perspective. Since college students primarily belong to the youth sector of the population, using youth statistics is expected to generate understanding and appreciations of the youth sector to which they belong and of themselves as a member of that sector and of the important role of that sector in society and in today's world.

In view of the philosophical orientation of general education as the groundwork for the development of a professionally competent, humane and moral person, the educational uses of youth statistics in the development and implementation of a general education statistics course, as outlined in this paper, will provide a better understanding among young people of their characteristics as a sector of the population. Further, the course will provide a springboard for developing statistical literacy skills and competencies among young people to meet the demands of 21st century society.

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