A 21ST CENTURY TEACHING APPROACH IN STATISTICS

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We surveyed 146 out of 217 students who took basic statistics course at the post secondary level. The objectives were to asses the current pedagogy in teaching statistics based on Bloom's Digital Taxonomy; determine software tools that facilitated the learning of statistics and identify the extent of the use of these resources; and revise the course syllabus in basic statistics to incorporate content and approaches to better match 21st century teaching-learning. The survey revealed that teachers in statistics were using a mixed approach – the traditional and digital approaches; that students were provided with computers in the laboratory with installed licensed statistical software, Word processing, and internet connection, and that they have good knowledge in using them. After the assessment, the course syllabus which contains recommended teaching strategies on the topic(s) was developed.

INTRODUCTION

Web 2.0 and other technology tools that have emerged led to the development of Bloom's Digital Taxonomy (iNACOL, 2012). Tishkovskaya and Lancaster (2012) concluded that computer-based and Web technologies are essential part of statistics education. While technology facilitates the visualization of statistical concepts (Chance et al., 2007), the internet has been a good source of data sets useful for interactive instruction and exercises (Tishkoyskaya & Lancaster, 2012). It is interesting, therefore, to assess the current pedagogy in teaching statistics in the University of the Philippines Cebu (UPC) based on the Bloom's Digital Technology.

The UPC offers basic statistics course to students in other disciplines such as Political Science, Computer Science, Management, Psychology, Biology and Mathematics. It has two statistics laboratory that contains 32 computers. Each computer has installed licensed IBM SPSS version 21, Word processing, slide show presentations, and spreadsheets. All computers are connected to a network. The laboratory is also equipped with LCD projector and screen, document camera, whiteboard and sound system. It is interesting to determine the approaches and other software tools that facilitate the learning of the students in statistics at the college level and identify the extent of the use of these resources.

The results of the assessment will be incorporated in the current course syllabus in statistics, the content and approaches that better match the 21st teaching-learning.

RESULTS AND DISCUSSIONS

A survey was conducted to 146 students out of the 217 who took the basic statistics course in UPC. The construction of questionnaire was based on Blooms' Digital Taxonomy. Chronbach alpha of 0.884 on Teacher's Factor questions, 0.748 on Traditional Approach questions, and 0.846 on Digital Approach questions show that the survey questionnaire is statistically reliable.

Pedagogy in Teaching Statistics at the Post Secondary Level

Teachers play a crucial role to the learning process as catalyst and facilitators of learning. This section presents the rating of the respondents on the teaching strategy on their teachers in statistics. Responses on the questions asked were in Likert Scale of 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree.

The respondents were asked if their teacher: 1) allowed the use of computer software (Microsoft Excel, SPSS) in solving statistical problems to lessen tedious computations and emphasize statistical applications.; 2) provided varied activities and inquiry plans which helped them deepen their knowledge and understanding of statistics; 3) guided them to learn how and where to find sources of information for concepts, questions/issues, and problems; 4) encouraged them to share observations, reflections, and ask questions through discussions, reports, activities, and projects; 5) gave them lessons that took into account true-to-life experiences and social realities; 6) emphasized and summarized key points for understanding; 7) facilitated classroom

discussions by starting with our past statistical knowledge and leading them towards understanding of statistical concepts we need to learn; 8) challenged them to uncover statistical facts and concepts in interdisciplinary contexts and build knowledge by observing, hypothesizing, experimenting, and discovering; 9) presented tasks/problems that are analogous or applicable to the challenges faced in the real world; and 10) encouraged them to think, solve and explain solutions to problems and not memorize formulas/procedures.

Most of the respondents answered agree. This means the students agreed that their mentors in statistics are indeed following the student-centered paradigm. They also agreed that their teachers provided varied activities that aide them to deeply understand the basic concepts of statistics. Moreover, they agreed that their teachers have guided and taught them the statistical facts and contexts they need in their various fields.

Students were also asked on the approaches their teachers used in the classroom. These were divided into traditional and digital approaches. Traditional approaches include: 1) note taking-hand written notes, 2) formal writing (answers in the laboratory class were hand-written), 3) drafting process (bound copies of notes), 4) reference books, 5) processing data, 6) presenting information (written on chalkboard, whiteboard), 7) use scientific calculator in solving problems, 8) research from newspapers, journals and magazines, 9) watching statistics lectures in CD/DVD, and 10) paper-based test.

Their responses revealed that most of the teachers are using traditional approaches. Most of the respondents agreed that most of the teachers are using hand-written notes, bound copies of notes, chalkboard/whiteboard, scientific calculators and paper-based test. However, many of the respondents disagreed that the teachers used newspapers, journals, and even watching lectures on CD/DVD in their instruction.

Among the digital approaches, the respondents had to identify what their teachers used in their statistics class: 1) digital notes (notes taken using camera), 2) word processing (answers in the laboratory class were encoded in notepad/MS Word/Open Office), 3) Collaborative documents (notes are shared online, google docs, dropbox, etc.), 4) notes are shared in email, 5) internet based research, 6) spreadsheets (electronic gadgets, statistical software), 7) slideshow, poster (powerpoint), 8) use of iPad/Tablet in note-taking, 9) use of digital/graphical calculator in solving problems, 10) use e-books as references, 11) use of blogging tools for taking notes, 12) watching youtube videos for lectures in statistics, 13) electronic tests, 14) chatroom/fb/email/twitter in the net for consultations.

The respondents agreed that the teachers used digital notes, online social networks for document sharing, word processing, spreadsheets, internet-based research, slideshow/poster, and digital/graphical calculator as a means of instruction. However, their responses revealed that most of the teachers were not using e-books for reference, blogging tools for note-taking, youtube videos for lectures, nor electronic tests and social networks for consultation.

Apparently, teachers in the basic statistics course used a mix of traditional and digital approaches.

Computer Skills Assessment

Though teachers play an important role in the learning of the students, technology is also the partner of the teachers in honing the minds of today's generation. Learning environment such as laboratories, facilities, libraries, etc. that shape the learning experience of students are deemed important since the process will enable the development and assessment of student learning competencies. In assessing the computer skills of the respondents, it was found out that almost all of the respondents had knowledge on word processing, email and internet and computer basics. They could create a new document, or could open a document, edit, print, save, change fonts and font sizes, and even create tables in it. Some respondents could create a merge form or use the merge function. Furthermore, some could create a new email account in Outlook, Outlook Express, or a similar email client.

The Proposed Course Syllabus
        Based on the assessment done, students were generally users of Web 2.0, statistical packages and other technological tools. Thus, the following course syllabus in basic statistics is proposed:

Course Outline	Recommended Teaching Strategies	Evaluation \ Assessment

1. Introduction
  1.1 Basic Concepts
  1.2 Fields of Statistics
  1.3 Steps in Statistical Inference
	Lecture discussion with the use of slideshow presentation
	Posting of lecture notes on fb/google docs/dropbox/etc.
		Seatwork

2. Collection and Presentation of Data		
2.1 Classification/Types of Data	Identification of types of data with the use of google images (google images animated in a slide show)	Assignment
2.2 Methods of Data Collection 2.3 Construction of Questionnaire	Fieldwork: Collect data using survey questionnaire, and by observation. Visit to statistical agencies (like NSO and BAS) to ask for large data sets.	Submission of survey questionnaires and data sets.

2.4 Methods of Sampling
  2.4.1 Probability Sampling
  2.4.2 Non-Probability Sampling
	Case Analysis: Use of iPad, tablet, cellular phones, laptop/netbook in google mapping and net surfing.	Exercises

2.5 Sample Size Determination	Manual Computation and the use of statistical software.	Quiz
2.6 Tabular and Graphical Presentation	Display of graphical and tabular presentation of data with interpretations in a class google group.	Laboratory Exercises
2.7 The Frequency Distribution Table (FDT)	Construction of FDT with the use of spreadsheet (MS Excel, Open Office, etc…)	Laboratory Exercises
2.8 The Stem-and-Leaf Display	Collection of different distributions and array as well using stem-and-leaf display with the use of digital camera. Displaying of the collection in a class google group.	Project
First Long Examination (Coverage: Chapters 1 and 2)		

3. Descriptive Statistics
  3.1 Measures of Central Tendency
  3.2 Measure of Dispersion
  3.3 Measures of Location
  3.4 Measure of Skewness
	Discussion with use of slide show presentations.
	Getting the summary measures using IBM SPSS 21.
	Encoding the interpretation using word processing (notepad/ openoffice/MS word) and saving it on the network.
		Laboratory Exercises

Second Long Examination (Coverage: Chapter 3)		
4. Probability, Probability Distributions, and Sampling Distributions	Watching statistics lecture in videos using DVD/CD and	Quiz Video Review

4.1 Random Experiments, Sample Space, Events 4.2 Properties of Probabilities 4.3 Random Variable: Discrete and Continuous 4.4 The Normal Distribution 4.5 Other Common Distributions 4.6 Sampling Distributions	youtube videos. Watching movies that unveil probabilities. Lectures in youtube videos on probability and sampling distribution.	Report
5. Statistical Inference		
5.1 Estimation 5.1.1 Point Estimation	Citing of real-life examples of point estimation (like estimate hours spent in texting/opening social networking sites such as twitter, instagram and facebook).	Quiz
5.1.2 Interval Estimation	Lecture-discussion using whiteboard and slide show presentation.	Board Work
Third Long Examination (Coverage: Chapters 4 and 5)		

5.2 Test of Hypothesis
    5.2.1 Basic Concepts
    5.2.2 One Population Case
    5.2.3 More than Two Population Case
    5.2.4 The Chi-square Test of Independence
	Use statistical software to test for hypothesis with one/two/more than two population cases and on independence.
	Exploration on the statistical tests with the use of local data.
		Laboratory Exercises

6. Regression and Correlation
    6.1 Correlation Coefficient
    6.2 Testing the Correlation Coefficient
    6.3 Simple Linear Regression
	Formulation of simple linear model and correlation with the use of statistical software.
	Use of graphical aids for model regression like the partial regression plot (PRL).
		Laboratory Exercises

Fourth Long Examination (Coverage: Chapters 5 and 6)		

CONCLUSION

The teachers in statistics were using a mixed approach - the traditional and digital approaches. Students were provided with computers in the laboratory connected in a network and with installed licensed statistical softwares, Word processing, and spreadsheets, among others. They have good knowledge in using them. The constructed course syllabus contains topics and recommended teaching strategies.

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