WHAT DO STATISTICIANS WORKING IN POLICY RESEARCH NEED FROM STATISTICAL EDUCATION?

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The purpose of this paper is to explore to what extent knowledge and skills provided to students majoring in statistics satisfy the expectations of the work environment in policy research centers. A list of items reflecting statistics knowledge and statistical skills as well as soft skills required for researchers working in policy research centers was developed. Then, the list was integrated in a pre-coded questionnaire addressed to junior statisticians working in policy research centers and their managers to measure statisticians' exposure to different items. The results showed a need for improving content of statistical education and indicated a need to emphasize statistical thinking in the cognitive formation of statistics graduates. The dose of statistical methods usually offered in a standard statistics program seems to be adequate and can help statisticians to analyze problems in an evidence-based manner. In addition, the results suggested that statistical education focuses on theoretical concepts rather than their application in real-world issues. Despite the fact that computer skills of statistics graduates are satisfactory, there is a need to improve their ability in conducting statistical analysis using database software.

1. INTRODUCTION

The Egyptian government has recently paid great attention to developing policy research centers. Policy research provides decision makers with action-oriented recommendations to deal with fundamental issues or problems. Essential ingredients of quality policy research include reliable, relevant and timely data and appropriate statistical techniques. Generally speaking, policymakers want the right information, in the right form, at the right time. Therefore, researchers working in policy research centers require statistical knowledge and concepts as well as soft skills. For example, statisticians in policy research centers need to phrase the raw results of statistical analyses in plain language that are understandable to the layperson. The role of statisticians inside policy research centers is increasing continuously as more complex problems appear and more information becomes available. As a result, the need for skilled statisticians is unlikely to decrease.

Traditional statistics education places much weight on statistics knowledge and less weight on statistical and soft skills such as statistical thinking, personal communications, and oral presentation. Moreover, it is often hypothetical and unconnected with observed phenomena. Consequently, statistics graduates lack the ability to reason statistically and deal with real life issues. Several endeavors have been trying to improve university education system. Thomas and Moore (1980) suggested the use of non-mathematical approaches to teach statistics using the computer simulations. Becker and Watts (2001) reported that there had been little change in economics teaching methods across U.S. universities between 1995 and 2000. Reid and Petocz (2002) and Petocz and Reid (2003) have investigated the views of statistics major students about their discipline and their learning. Gordon et al. (2005) stated that communications skills are not at the forefront of the soft skills promoted by statistics professors at university.

The widening mismatch between the increasing demand and short supply of skilled statisticians in policy research centers raises important implications for teaching statistics methods at university. Maligalig (1994) reviewed and explained the uses of data and statistical methodologies in policy research in the Philippine setting. Smith (2001) suggested that statisticians should encourage an evidence based society as a possible route to raising statistical awareness. Martin and Luis (2002) discussed the challenges that face the training of official statisticians. May (2004) suggested different guidelines to make statistics more meaningful for policy research and program evaluation.

The objective of this paper is to explore to what extent knowledge and skills provided to students majoring in statistics satisfy the expectations of the work environment in policy research centers. The paper may be an initial step in a reform movement towards bridging the gap between what is being needed in policy research centers and what is being taught in the university statistics programs. The methodology used in this paper is based on conducting a survey to collect data about the opinions of junior statisticians and their managers about the use of statistical education in work at policy research centers.

The rest of the paper is structured as follows. Section 2 explains the employed questionnaires and presents the respondents' characteristics. The results of the study are explained and discussed in section 3. Some Concluding remarks are given in section 4.

2. SURVEY AND RESPONDENTS

Data collection process started with designing two pre-coded six-page questionnaires. The first questionnaire was addressed to the junior statisticians working in the policy research centers at the Egyptian Cabinet's Information and Decision Support Center (IDSC), while the second one was addressed to their managers. The second questionnaire included the six parts of the first one with one extra part. Both questionnaires started by introductory part where respondents were asked about their personal details such as their department, job level, year of joining IDSC, year of graduation, major specialization, faculty, university and last educational degree.

In the first five parts of both questionnaires, respondents were asked to provide information for five groups of items where each part corresponds to one group. These groups were statistical knowledge, statistical concepts, general developmental issues, data sources, and skills. In each part, respondents were asked to assign a grade on scale from 0 to 10, on relevant items, expressing their opinions about the degree of use they think junior statisticians working at IDSC gained from their university statistical education to meet IDSC requirements. A grade of 0 indicated the lowest use whereas a grade of 10 indicated the highest use.

The first part of the questionnaire given to junior statisticians was designated to collect opinions about statistical knowledge and consisted of 14 items that included designing graphs, preparing statistical tables, designing questionnaires, designing databases, introductory statistical analysis, advanced statistical analysis, constructing simple indicators, constructing composite indicators, measuring public opinion, time series analysis, sampling, population projections, simulation techniques and writing statistical reports.

The second part of the questionnaire dealt with statistical concepts and consisted of 15 items that included sampling error, inflation rate, human development index, price index number, unemployment rate, total fertility rate, crude birth rate, sex ratio, probabilistic sampling, education dropping-out rate, Case 30 index, per capita GDP, trade balance deficit, life expectancy and population ratio below poverty line.

The third part was concerned with general developmental issues and consisted of 15 items that included restructuring subsidies, child labor, population problem, political reform, information dissemination policies, circumcision, brain drain, good governance, human development, decentralization, EU, UNDP, privatization, parliamentary elections and combatting corruption.

The fourth part of the questionnaire was dedicated for data sources that included the population census, HICS, sample labor force survey, DHS, economic census. The fifth part was about skills which included preparing PowerPoint presentations, presenting a study's results, discussing and giving comments in seminars/forums, critical thinking, team work, suggesting an opposing opinion to the majority, defending an opposing opinion to the majority, designing posters/bulletins, expressing an opinion in a foreign language, using the internet to search for information, using the internet to search for studies and researches, conducting interviews to collect data, statistical analysis using Excel, statistical analysis using a statistical package and participating in a virtual panel discussion on the internet.

The sixth part of the questionnaire asked respondents an open question about their proposals to develop the system of statistical education for a better qualification of graduates to fit into the labor market. The seventh and last part of the managers' questionnaire asked the

managers an open question about their priorities for statistical training offered to researchers working at IDSC.

The first questionnaire was filled out by 24 junior statisticians with about 75% response rate. Responding junior statisticians were working in different departments or policy research centers of IDSC that included the departments of policies' monitoring and evaluation, data quality, information dissemination and information analysis, in addition to the public opinion poll and social contract studies centers. One third of the junior statisticians who participated in the survey joined IDSC in 2005 whereas about one fifth of them were graduated in 2002. All junior statisticians who filled out the questionnaire were graduated from the faculty of economics and political science at Cairo University and 62.5% of them carry only a bachelor degree in statistics while 29.2% of them started their master studies.

The second questionnaire was filled out by 12 middle and upper level managers working at IDSC. About 18% and 36% of responding managers joined IDSC in 1996 and 2007 respectively. One third of responding managers were graduated between 1985 and 1987. The majority of these managers were graduated from the faculty of economics and political science at Cairo University, had studied statistics as their major specialization and have PhDs (58.3%) while about one third of them have master degrees.

3. RESULTS

In order to analyze the respondents' opinion grades about making use of the statistical education in meeting IDSC requirements, two sets of box plots are constructed. The first set represents the junior statisticians' opinion grades for each item of the questionnaire while managers' opinion grades for each item of the questionnaire are represented by the second set. The rationale for using box plot is that it shows the median and the interquartile deviation of the grades. While the median represents the grades on average, the interquartile deviation is used as an objective and rigorous measure of respondents' consensus, Rayens and Hahn (2000), where smaller values indicate higher degree of consensus i.e. less variability. The interquartile deviation is defined as the absolute difference between the third quartile and the first quartile.

The two sets of box plots for the junior statisticians' and their managers' opinion grades for the first group of items are constructed and displayed in figure 1. The results show that both statisticians and their managers have high consensus on the high use of statistical education in designing graphs, preparing statistical tables and conducting an introductory statistical analysis where median grades ranged between 8 and 9 out of 10 and small interquartile deviation ranged between 2 and 3.

On the opposite side, junior statisticians have moderate consensus that statistical education did not help them enough in designing databases, constructing composite indicators and measuring public opinion. The median grades ranged between 2 and 3 out of 10 and the interquartile deviation ranged between 4 and 6. It is interesting to note that the managers were exaggerating compared to the junior researchers concerning these three items giving a median grade between 4 and 6 out of 10 with moderate consensus.

Regarding the rest of the statistical knowledge group items, both the statisticians and their managers have high median grades indicating the use of statistical education in meeting the IDSC requirements. Moreover, the managers' opinion grades have higher consensus than those of junior statisticians. All in all, the results showed the adequacy of the statistical knowledge dose usually offered by the statistical education.
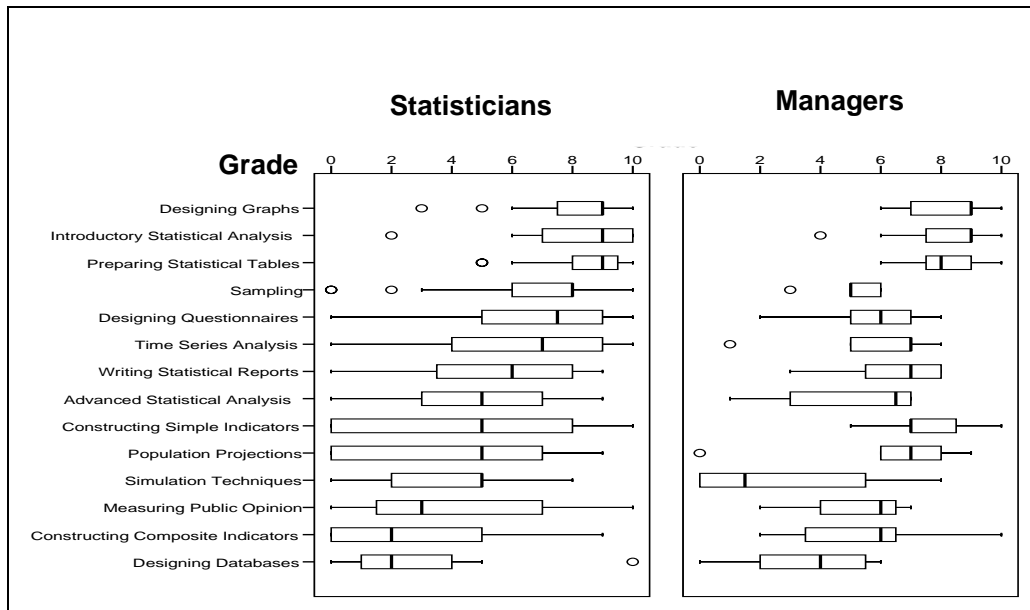
Figure 1. Box plots of opinion grades of statistical education use in meeting IDSC requirements for statistical knowledge items.

The survey results for the statistical concepts group are presented in figure 2. They show that, both junior statisticians and their managers agreed (with different levels of consensus) on the high benefit of statistical education in the upper 10 concepts (see figure 2). These concepts include the crude birth rate, life expectancy, total fertility rate, per capita GDP, probabilistic sampling, sex ratio, trade balance deficit, unemployment rate, sampling error, and inflation rate. The median grade of benefit for these concepts ranged between 6 and 9.

On the other hand, the junior statisticians (with low consensus) see that statistical education did not help them with the lower five concepts which include case 30 index, education dropping-out rate, population ratio below the poverty line, human development index, and the price index number. Although, the managers do agree with statisticians about the case 30 concept, they have different views regarding the other lower four concepts. While the median grade of junior statisticians' opinions for the lower five concepts was below 6, the median grade of managers' opinions was above 6.
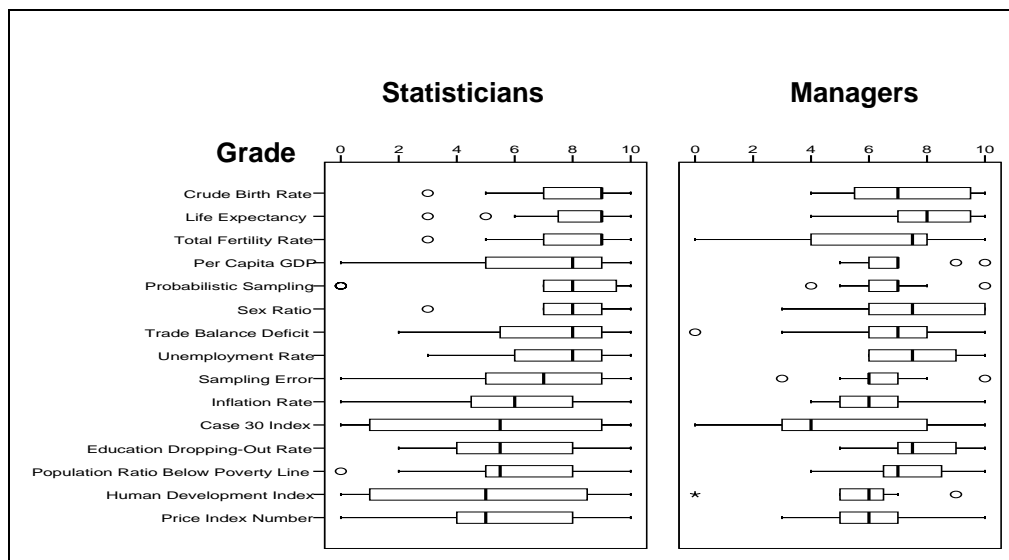

Figure 2. Box plots of opinion grades of statistical education use in meeting IDSC requirements for statistical concepts items.

Inspection of the survey results for the third group indicated that statistical education does not give much attention to general developmental issues. The median grades of junior statisticians' opinions concerning the parliamentary elections, population problem and European Union (EU) were only between 5 and 6. This is relatively poor compared to the grades of statistical knowledge or concepts. This implies that statistical education focuses on theoretical concepts rather than their application in real-world issues. Restructuring subsidies, information dissemination policies, good governance, combatting corruption, circumcision and brain drain are among the issues that receive the least attention by statistical education according to junior statisticians' opinions. The median grades concerning all of these issues were only 1. Junior statisticians have high consensus regarding these issues as the interquartile deviation ranged between 2 and 5. However, on the other side, the managers were exaggerating concerning general developmental group of issues and gave median grades between 4.5 and 7 but they have lower consensus compared to the junior statisticians as their interquartile deviation was between 4 and 6.
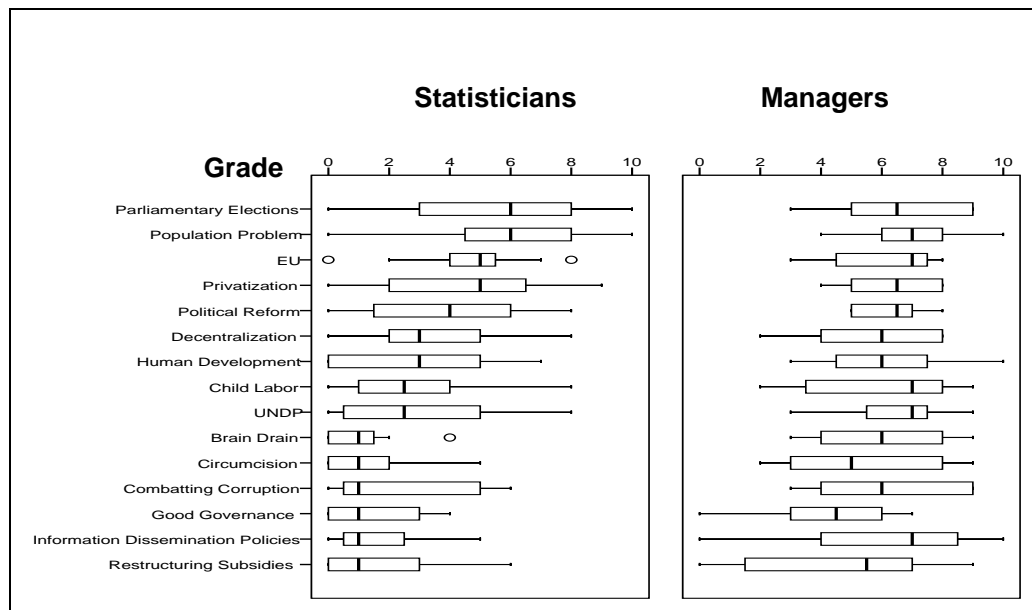

Figure 3. Box plots of opinion grades of statistical education use in meeting IDSC requirements for general developmental issues items.

Exploring the results for data sources group reveals that both junior statisticians and their managers, agreed on the high benefit from statistical education concerning the population census with a median grade of 8 out of 10 for both. However, the junior statisticians have higher consensus than that of their managers as the interquartile deviation of the statisticians' opinions in this case was 3 while it was 5 for the managers' opinions. On the opposite side, junior statisticians and their managers agreed again on the low benefit from statistical education for the economic census. However, there is a big gap between their median grades as it was 1 for the young employees and 6 for their managers. In addition, the statisticians and their managers have completely different opinions about the benefit from statistical education for the other three items namely, sample labor force survey, HICS, and DHS. While statisticians see that the statistical education was not beneficial for these three topics with median grades below 5, the managers see the opposite with median grades over 6.
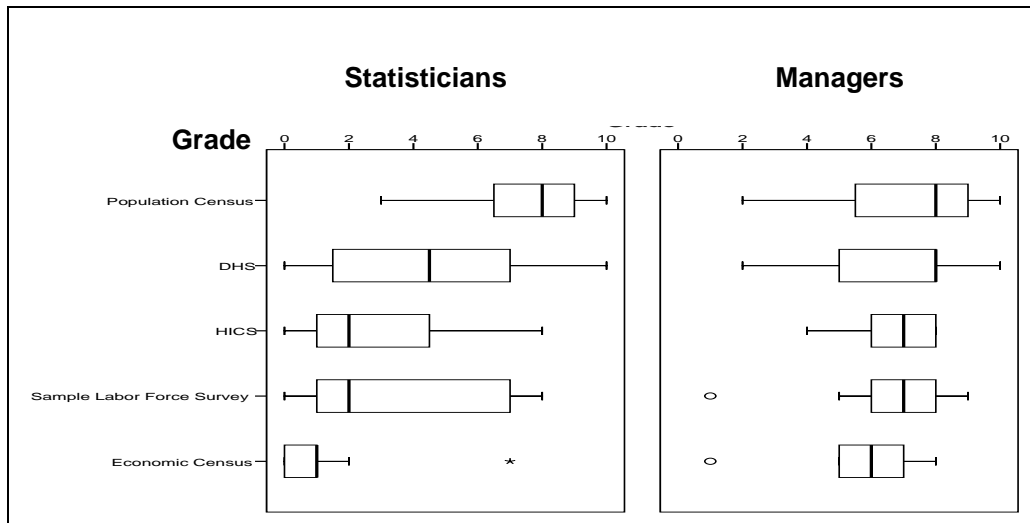
Figure 4. Box plots of opinion grades of statistical education use in meeting IDSC requirements for data sources items.

The six top-ranked skills that were chosen by junior statisticians were analyzing data using a statistical package, conducting interviews to collect data, internet search for studies, internet search for information, presenting a study's results, and team work. The statisticians' median grades for these skills were between 7 and 9 with moderate consensus for each item. The junior statisticians identified the six bottom-ranked skills that were critical thinking, defending an opposing opinion to the majority, discussing and giving comments in seminars/forums, expressing opinion in a foreign language, designing posters/bulletins, and participating in a virtual panel discussion on the Internet. The median grades for these skills, except for participating in a virtual panel discussion on the Internet, were below 6 with varying moderate consensus. The zero median grade with zero interquartile deviation of participating in a virtual panel discussion on the Internet means that the junior statisticians with complete consensus saw that the statistical education did not help at all in developing this skill. Interestingly, the managers saw that statistical education benefited statisticians for all skills even the skill of participating in a virtual panel discussion on the Internet with median grades that varied between 6 and 8.5.
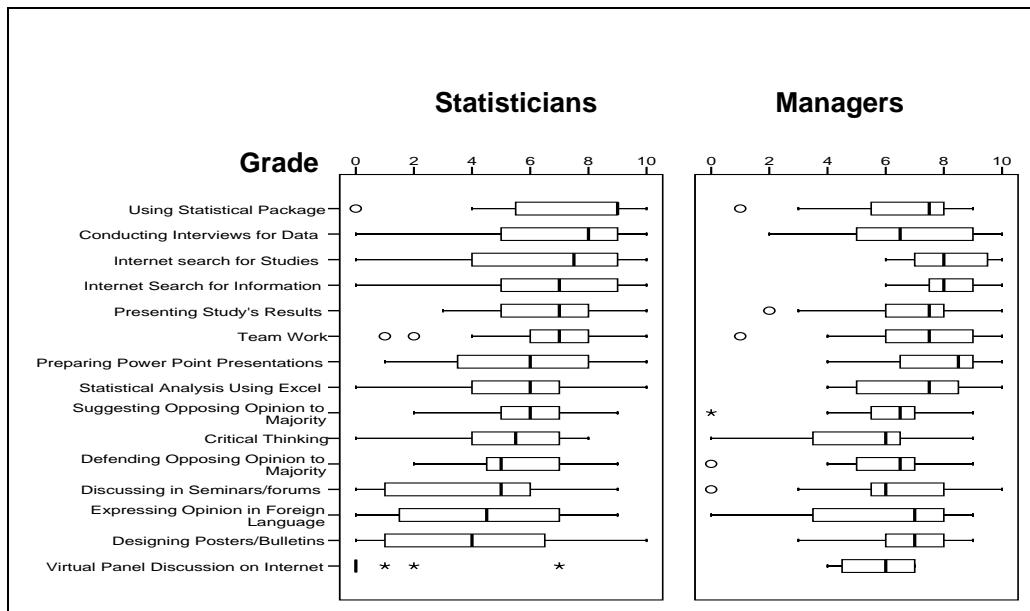

Figure 5. Box plots of opinion grades of statistical education use in meeting IDSC requirements for skills items.

When asked about their proposals to develop the statistical education system, both the junior statisticians and their managers suggested (1) developing teaching materials to balance between the theoretical and practical sides, and (2) implementing the students' graduation projects using surveys methodology. Moreover, the junior statisticians proposed investigating different practical studies conducted by local and international statistical entities such as the Central Agency for Public Mobilization and Statistics (CAPMAS) and International Monetary Fund (IMF). The managers have also stressed on focusing on sampling and enhancing statisticians' skills in preparing reports, presenting studies' results and thinking critically.

On the other side, when managers were asked about their proposals for the statistical training priorities need to offered at IDSC, they suggested (1) presenting statistical results, (2) using the new up-to-date statistical packages, (3) advanced statistical analysis, and (4) constructing composite indicators in various fields such as economics and education.

This study suffered from a number of limitations. The first one is that the sample size of respondents was small and it was not randomly selected. Although, such characteristics are standard for qualitative studies (Bernard, 1995), it is difficult to generalize the results. Another potential drawback of this type of research is the seemingly subjective nature of coding narrative.

4. CONCLUSIONS

The study has shed light on the gap between what is taught to students majoring statistics and the work requirements in policy research centers. The results showed the adequacy of the statistical knowledge and concepts. On the other side, the analysis revealed that statisticians are lacking awareness of general developmental issues such as good governance and restructuring subsidies and soft skills such as critical thinking.

The results of the current study provide promising directions for future research on developing the standard statistical education system to meet the statistical requirements in policy research centers.

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