

# Research And Statistical Knowledge of the 21st Century In-Service Teachers

MA. BETTY PARAME- DECIN AND JOSEPHINE BAEL- MARTINEZ

Jose Rizal Memorial State University-Katipunan Campus

Katipunan, Zamboanga Del Norte

decinma\_betty@yahoo.com

*Abstract* — The teacher's knowledge of research and statistics played a significant role in handling research subjects in the curriculum. Mastery of basic statistics and research content, as well as its pedagogy, is required for school teachers to effectively teach the topic. The study aimed to determine the knowledge of 21st-century in-service teachers teaching statistics and research subjects in government schools. This study was conducted on the teachers handling the K-12 curriculum, specifically the Grades 11 and 12 teachers, for the school year 2021–2022, in the selected barangays of the Municipality of Katipunan, Zamboanga del Norte. The descriptive survey method was used with the aid of the questionnaire and purposive sampling. The result revealed that government teachers lacked knowledge of statistics and statistical software but were knowledgeable in research. It is recommended that the government continue its professional development program to bring teachers up to standards to provide an applicable and determinable impact of the teacher's professional ability on the students' learning as well as the realization of their professional commitment.

*Keywords* — *Research and Statistical Knowledge, 21st Century In-Service Teachers*

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## I. Introduction

Nowadays, research and statistics are part of the mathematics curricula for primary and secondary school classes in many countries. The reasons to include statistics teaching have been repeatedly highlighted over the past 20 years (Gal, 2002) and include the usefulness of statistics for daily life, its instrumental role in other disciplines, the need for basic statistical knowledge in many professions, and its role in developing critical reasoning. The K-12 curriculum is research-driven, and statistics are very useful. Mastery of basic statistics and research content, as well as its pedagogy, is required if schoolteachers are to carry out an effective teaching of the topic and should therefore be included in their training.

Progress in the 21st century is impossible without research. Research is responsible for new products, new knowledge, and new ways of undertaking projects. The values of research to humanity are immeasurable. Research has proved to be an essential and powerful tool leading to human progress. The advent of the 21st century reoriented research towards good life with others to attain sustainable growth (Magulod et al.,2023).

Statistical methods and analyses are often used to communicate research findings, support hypotheses, and give credibility to research methodology and conclusions. It is important for researchers and also consumers of research to understand statistics so that they can be informed, evaluate the credibility and usefulness of information, and make appropriate decisions. Continuing professional development is relevant to enhance and maintain the teachers' competencies and helps them to understand that statistics and research are useful in their students' professional and personal lives and that their students can be trained to understand and use statistics (Schau, 2003). The researchers described the knowledge of teachers in research and statistics that was carried out in the K–12 curriculum in this paper.

The results of this study will be used by the researchers to discuss with the teachers the pedagogical content knowledge involved in the teaching and learning of research and statistics subjects in the K–12 curriculum. This is the focus of one of the College of Education's extension programs in assessing what research and statistical knowledge teachers need to develop, as well as how to articulate content knowledge and pedagogical content knowledge in teacher training.

## II. Methodology

The descriptive survey method was used in this study to determine the knowledge of the government teachers handling research and statistics subjects with the aid of the questionnaire. Purposive sampling was used to conduct this study on teachers in charge of the K-12 curriculum, specifically Grades 11 and 12, for the school year 2021-2022 in the Municipality of Katipunan, Zamboanga del Norte. The researchers used Slovin's formula to get the 126 respondents as the sample size.

The researchers created questionnaires from various research on the website and used the data to create questionnaires for respondents to fill out. This was adapted from the study of Yarullin et al. (2015), "The Research Competence Development of Students Trained in Mathematical Direction," and from the study of Mustafa Celebi1, "Investigation of the Attitudes and Competencies of Teachers in Project Schools Towards Scientific Research in a Developing Country." Before distributing the questionnaires, they underwent validation by experts to check or prove the validity or accuracy of the questionnaire.

Frequency count was used to determine the profile of the respondents in terms of specialization, length of service, and educational qualification.

A weighted mean was used to determine the level of knowledge of the teachers, and the following range and descriptions were used:

| <i>Scaling:</i> | <i>Mean Range</i> | <i>Description</i>      |
|-----------------|-------------------|-------------------------|
| 5               | 4.21-5.00         | Very Much Knowledgeable |
| 4               | 3.41-4.20         | Much Knowledgeable      |
| 3               | 2.61-3.40         | Knowledgeable           |
| 2               | 1.81-2.60         | Less Knowledgeable      |
| 1               | 1.00-1.80         | Not Knowledgeable       |

### III. Results and Discussion

**Table 1 Profile of the Respondents in terms of “Specialization”**

| Specialization            | Frequency | Percentage |
|---------------------------|-----------|------------|
| Math                      | 24        | 19.05 %    |
| Science                   | 23        | 18.25 %    |
| English                   | 20        | 15.87 %    |
| Filipino                  | 14        | 11.11 %    |
| T.L.E.                    | 15        | 11.90 %    |
| MAPEH                     | 13        | 10.32 %    |
| Araling Panlipunan        | 8         | 6.35 %     |
| Edukasyon sa Pagpapakatao | 9         | 7.14 %     |
| Total                     | 126       | 100.00 %   |

Mathematics major respondents were dominant, with the highest frequency of 24 or 19.05%. This implies that, usually in the senior high school curriculum, the math majors are given the research and statistics subjects to teach. Ball & Bass (2009) further identify Horizontal Content Knowledge as an awareness of how mathematical topics are related over the span of mathematics included in the curriculum, or the "mathematical peripheral vision," a view of the larger mathematical landscape (Ball & Bass, 2009, p. 1). According to Kahan, Cooper, and Bethea's (2003) review, researchers frequently conclude that "students would learn more mathematics if their teachers knew more mathematics," but content knowledge in the subject area does not suffice for good teaching. However, they also stated that the content of pedagogical content knowledge is "content-specific and goes beyond simple mathematical knowledge." Therefore, a mathematician may not possess it.

**Table 2 Profile of the Respondents in terms of “Length of Service”**

| Years | Frequency | Frequency |
|-------|-----------|-----------|
| 0-4   | 29        | 23.02%    |
| 5-9   | 33        | 26.19%    |
| 10-14 | 32        | 25.40%    |
| 15-19 | 21        | 16.67%    |
| 20-24 | 8         | 6.35%     |
| 25-29 | 3         | 2.38%     |
| Total | 126       | 100%      |

The highest frequency obtained by the years of service is within the range of 5–9 with a frequency of 33, or 26.19%. This implies that in teaching, the number of experiences that promote the education, training, and development opportunities of students really affects the students’ performance. In this vein, professional development applies to a full range of activities that attempt to increase the knowledge base, skill set, or attitudinal perspectives brought to bear in teaching (Harvard Family Research Project, 2006). Practicums are an essential part of any teacher training program because they provide student teachers with the most valuable learning opportunities (Maglente et al.,2023).

**Table 3 Profile of the Respondents in terms of “Educational Qualification”**

| Educational Qualification | Frequency | Percentage |
|---------------------------|-----------|------------|
| PhD/EdD                   | 1         | 0.79%      |
| CAR (PhD/EdD)             | 3         | 2.38%      |
| MA/MS                     | 8         | 6.35%      |
| CAR (MA/MS)               | 11        | 8.73%      |
| BS                        | 103       | 81.75%     |
| Total                     | 126       | 100%       |

Most of the teachers are Bachelor of Science degree graduates, which obtained a frequency of 103, or 81.75%. This indicates that their knowledge of statistics and research is lacking unless they pursue their master's or doctoral degree courses. Taking master's or doctoral degree courses may enhance one’s knowledge of statistics and research. A master’s degree does not only deepen one’s education but also allows one to contribute outside of the classroom. The demand for services in the education and not-for-profit sectors continues to grow, and as a highly-skilled master’s degree recipient, one will be able to fulfill those roles. Choosing to pursue a master’s degree takes initiative and commitment. The same traits, along with the newly gained knowledge and skills, will make one a successful leader and innovator when he or she completes his or her degree.

**Table 4 Basic Statistics Knowledge of the Teachers**

| Statistics Competencies                                     | Weighted Mean | Verbal Description |
|---|---------------|--------------------|
| Basic Statistics Competency                                 | 3.38          | Knowledgeable      |
| Descriptive Statistics: Tabular and Graphical Presentations | 3.27          | Knowledgeable      |
| Descriptive Statistics                                      | 2.43          | Less Knowledgeable |
| Estimating Population Parameters: Statistical Inference:    | 2.22          | Less Knowledgeable |
| Select an Appropriate Statistical Test                      | 2.04          | Less Knowledgeable |
| Correlation and Regression                                  | 2.45          | Less Knowledgeable |
| The Chi-Squared Tests of Proportions                        | 2.18          | Less Knowledgeable |
| Non-Parametric Methods                                      | 2.13          | Less Knowledgeable |
| Methods of Sample Selection                                 | 2.92          | Knowledgeable      |
| Grand Total   | 2.56          | Less Knowledgeable |

The grand total weighted mean of the basic statistics knowledge of the respondents is 2.56, which is described as "less knowledgeable." This implied that the teachers lacked the knowledge to teach research subjects in the curriculum. They are less capable of supporting students to collect, analyze, and interpret the research data. They need to be equipped with these competencies in order to handle research subjects. The analysis (Estrada et al., 2008) suggests that veteran teachers had a greater tendency to suppress statistics when possible and found statistics more difficult than younger teachers. This is particularly relevant in educating teachers since an appropriate use of statistics would make them believe that statistics are useful in their students' professional and personal lives and that their students can be trained to understand and use statistics (Schau, 2003). Poor attitudes towards statistics among teachers might also be later transmitted to their own students when teaching the topic.

**Table 5 Research Competencies of the Teachers**

| Research Competencies                                   | Weighted Mean | Verbal Description |
|---|---------------|--------------------|
| Recognizing and identifying a topic to be studied.      | 2.7           | Knowledgeable      |
| Selecting an appropriate sample of participants         | 2.2           | Less Knowledgeable |
| Collecting valid and reliable data.                     | 2.18          | Less Knowledgeable |
| Reporting conclusions.                                  | 2.98          | Knowledgeable      |
| Making recommendations.                                 | 3.4           | Knowledgeable      |
| 6. Choose a problem                                     | 3.2           | Knowledgeable      |
| 7. Review the literature                                | 3.76          | Knowledgeable      |
| 8. Evaluate the literature                              | 3.38          | Knowledgeable      |
| 9. Be aware of all ethical issues                       | 3.0           | Knowledgeable      |
| 10. Be aware of all cultural issues                     | 3.2           | Knowledgeable      |
| 11.State the research question or hypothesis            | 3.13          | Knowledgeable      |
| 12.Select the research approach                         | 3.29          | Knowledgeable      |
| 13.Determine how the variables are going to be measured | 3.27          | Knowledgeable      |
| 14. Select a sample                                     | 3.33          | Knowledgeable      |
| 15. Select a data collection method                     | 2.27          | Less Knowledgeable |
| 16. Collect and code the data                           | 2.47          | Less Knowledgeable |
| 17. Analyze and interpret the data                      | 2.12          | Less Knowledgeable |
| 18. Write the report or findings.                       | 2.80          | Knowledgeable      |
| 19. Disseminate the report                              | 3.0           | Knowledgeable      |
| Grand Total   | 2.93          | Knowledgeable      |

The grand weighted mean obtained from the research competencies of the respondents is 2.93, which is described as "knowledgeable." This indicated that they have an average knowledge of research. This result emphasizes the essentials that teachers require in order to meet the challenges of the twenty-first century classroom. It embodies the value of paradigms as well as the skills and knowledge of research that teachers need, which puts the learner at the center of the equation. Numerous studies revealed that teachers who had a thorough understanding of mathematics could use a variety of mathematical examples in their lessons. For instance, a teacher's understanding of the relationships between the ideas in a given topic has the ability to predict how well they will teach (Moliner & Alegre, 2022; Tchoshanov, 2011; Walshaw, 2012).

**Table 6 Knowledge on the Application of “Statistical Software” by Teachers**

| Statistical Software | Weighted Mean | Verbal Description |
|----------------------|---------------|--------------------|
| 1. SPSS              | 2.0           | Less Knowledgeable |
| 2. Minitab           | 2.0           | Less Knowledgeable |
| 3. StatPlus          | 2.10          | Less Knowledgeable |
| 4. Excel             | 2.23          | Less Knowledgeable |
| Grand Total          | 2.08          | Less Knowledgeable |

The knowledge of teachers as to the "**Statistical Software**" application obtained the grand total of the weighted mean of 2.08, which is described as "less knowledgeable." This implies that the teachers lack knowledge of how to use the statistical software in computing and analyzing research data. Statistical software is very useful for teachers handling research subjects because it delivers faster performance, more efficient processing of large datasets, provides detailed benchmarking results, and addresses other important benefits such as job automation, scheduling, and scoring data. Since attitudes towards statistics play a key role in predicting statistics achievement (Onwuegbuzie, 2003), teacher educators are responsible for creating an emotionally and cognitively supportive environment in statistics training where prospective teachers explore different statistical methods, gain confidence in their own ability to learn and teach statistics, and learn to value the role of statistics in modern society. Finally, we draw attention to the need to find more methods to convince both teacher trainers and prospective teachers that statistics are valuable and that basic statistics can be taught in an attractive and easy way. The first step toward achieving these aims is to continue with research aimed at describing teachers' attitudes toward statistics and finding possible explanatory variables.

#### IV. Conclusion

1. Teachers are knowledgeable in research but less knowledgeable in statistics and statistical software applications.

#### V. Recommendations

1. Teachers in the government may understand the logic of research on how to gather, tally, analyze, and interpret data.
2. The government may continue its professional development program to bring teachers up to standards established to provide applicable and determinable impacts on professional competencies on students' learning as well as on teachers' abilities in their professional commitment.

3. Teachers may pursue graduate and postgraduate studies in their own field of specialization to enhance their professional qualifications and become more competent teachers.

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