

Information and Communication Technology: Its Impact to Statistics and Probability Instruction as Perceived by Grade 11 Teachers in Santiago City Public Schools

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ABSTRACT

This study aimed to investigate the effect of integrating Information and Communication Technology (ICT) in Statistics and Probability instruction as perceived by Grade 11 Mathematics teachers in the public secondary schools of Santiago City Schools Division. Utilizing a descriptive survey research design, the study purposively selected 23 teacher-respondents across nine public schools. Data was collected using a researcher-made questionnaire assessed via a 5-point Likert scale and analyzed using frequency counts, percentage distributions, and weighted means. The findings revealed that the respondents strongly agreed on the benefits of ICT, particularly in aiding teachers to access online academic resources and supporting a student-centered teaching approach. The integration of ICT was perceived as very

effective, especially in making the mathematics education curriculum more meaningful. Furthermore, the teacher-respondents demonstrated a very proficient level in using ICT tools such as projectors, emails, and presentation software. While the overarching challenges in using ICT were deemed "least serious," the most prominent issues encountered were related to school facilities, specifically the stability and speed of internet services. In conclusion, ICT possesses a profound impact on Statistics and Probability instruction, making teaching more effective and significantly improving student engagement and comprehension. However, to fully maximize its potential, the study recommends strategic resolutions to address infrastructural bottlenecks, such as ensuring consistent funding for digital tools and optimizing internet connectivity within school premises.

Keywords: *Information and Communication Technology (ICT), Statistics and Probability, Mathematics Education*

INTRODUCTION

The successful incorporation of technology in Statistics and Probability relies fundamentally on the teacher, yet the actual level of skill applied remains a significant challenge for many educators. The degree and type of technology utilized in teaching are highly variable, as they are contingent upon the teacher's personal proficiency, their understanding of mathematical knowledge, and their specific methods for imparting this knowledge to learners. Consequently, an educator's underlying beliefs regarding the principles of Statistics and Probability profoundly influence their learning environment and their approach to Information and Communication Technology (ICT). Because Mathematics is generally portrayed as one of the most difficult subjects to teach across all learning situations, researchers have continuously exhausted efforts to analyze the factors that affect its instruction, including the integration of ICT in the classroom.

ICT possesses inherent affordances that enable teachers to deliver Mathematics instruction more effectively. Its pedagogical integration paves the way for the provision of better computer services in schools, including stable Internet access and an abundance of academic application software and digital resources. For learners, ICT serves as a practical tool to perform calculations, draw graphs, and solve complex problems through accessible means, such as the calculator features on mobile phones or computer spreadsheets. However, maximizing these tools requires teachers to have a solid grasp of modern teaching strategies. Therefore, continuous exposure to professional workshops, training, collaborative resource development, and effective classroom management design are crucial to aid teachers in their practice and professional development.

In the Philippines, the drive to modernize education is anchored in Republic Act No. 10533, which mandates the state to create a functional basic education system that equips citizens with essential competencies, skills, and values for lifelong learning and employment. Despite this clear statutory directive, educators attempting to integrate ICT into a challenging discipline like Statistics and Probability are frequently confronted with several constraining factors and practical barriers.

Driven by these instructional challenges, the researcher—an active Statistics and Probability teacher at Santiago City National High School (SCNHS)—initiated this study to investigate the reality of ICT incorporation in the classroom. The primary objective is to thoroughly probe the effect of integrating Information and Communication Technology in Mathematics Education within the public schools of the Santiago City Schools Division. Specifically, the study seeks to evaluate the perceived benefits, the overall effects on learning, the proficiency levels of the educators using these tools, and the specific challenges encountered by Grade 11 teachers in delivering ICT-aided Statistics and Probability instruction.

Literature Review

The integration of contemporary information and communication technologies (ICT) is recognized as a key factor in the success of modern educational systems, significantly altering curricular content, pedagogy, and the nature of mathematical thinking in Statistics and Probability instruction (Wiest, 2001). Traditional methods of teaching that rely on passively presenting information are increasingly viewed by modern students as obsolete and unengaging, making the intensive use of technology highly motivating and necessary (Passey et al., 2004). However, educational literature cautions that technology cannot be used as a shortcut for genuine knowledge and skills acquisition, though it remains a powerful aid that enhances the effectiveness of teaching basic mathematical concepts (Toyama, 2011). In this context, ICT represents a diverse set of digital tools and devices used to create, distribute, and manage information, encompassing hardware like computers, application software, and vast delivery systems like the Internet.

The successful implementation of these digital tools relies heavily on the teacher's foundational statistical proficiency and pedagogical strategies. Literature highlights a significant concern regarding teacher preparation, revealing that many mathematics instructors unconsciously share various difficulties and misconceptions with their students concerning fundamental statistical ideas (Batanero & Díaz, 2010). Common conceptual challenges include possessing little real understanding of the mean and median, struggling to create or interpret graphs, confusing correlation with causation, and exhibiting limited comprehension of standard deviation as a measure of sample homogeneity (Batanero & Díaz, 2010). Furthermore, because many teachers lack prior hands-on experience using statistical investigations to conduct probability experiments, they often struggle to implement experimental approaches in the classroom, sometimes relying exclusively on small, inadequate sample sizes (Stohl, 2005). To overcome these instructional gaps, literature emphasizes the need for teachers to develop specialized Pedagogical Content Knowledge (PCK) and Technological Pedagogical and Content Knowledge (TPACK) designed specifically for data analysis and probability (Lee et al., 2010).

When applying these competencies, experts strongly advocate for a pedagogical approach centered on teaching the subject rather than merely teaching the tool (Moore, 1997). Technology should not be utilized blindly for the sake of using it—such as entering raw numbers into a graphing calculator just to calculate statistical

summaries—nor should it be used for "pseudo-accuracy" by carrying out mathematical results to a meaningless number of decimal places (Friel, 2007). Instead, the most appropriate and effective uses of educational technology involve accessing and interpreting large real-world datasets, automating tedious calculations, generating and modifying dynamic statistical graphics, and performing digital simulations to clearly illustrate abstract concepts (Chance et al., 2007).

Despite the immense potential of ICT to enhance interactive learning, translating that potential into classroom reality is frequently hindered by distinct systemic and personal barriers. Research consistently identifies multiple constraining factors that educators face, including a severe lack of access to digital resources and school hardware, limited personal time for software integration during lesson preparation, and frequent encounters with technical problems while software is in use (Jones, 2004). Furthermore, a lack of adequate technical support and insufficient professional ICT training deeply impact the ability of teachers to seamlessly adopt these tools (Zakaria & Khalid, 2016). While many teachers demonstrate positive attitudes and a general readiness toward technological integration, pre-service and starting teachers often experience computer anxiety due to the competing demands of classroom management and curriculum familiarization (Aslan & Zhu, 2016)

METHODS

Research Design

This study utilized a descriptive survey research design to establish the findings of the inquiries posted in the statement of the problem. This specific method was chosen to accurately describe how the teacher-respondents perceived the incorporation of Information and Communication Technology (ICT) in mathematics instruction within the public secondary schools of Santiago City. Furthermore, the design involved a systematic process of obtaining, classifying, analyzing, and allotting data regarding current situations, processes, practices, and trends so that they could be interpreted meaningfully. The researcher noted that this method is highly advantageous because it is less expensive, less time-consuming, and allows for the efficient collection of a large amount of data for detailed studying. Finally, because the descriptive survey method is used primarily to describe existing conditions rather than to make definitive causal conclusions, it serves as an accessible starting point for the research that can effectively identify further areas of study.

Research Locale

This study was conducted within the jurisdiction of the Santiago City Schools Division, specifically encompassing nine public secondary schools. The research locale selected for the data gathering included Cabulay High School, Divisoria High School, Naggasican National High School, Patul National High School, Rizal National High School, Rosario National High School, Sagana National High School, Santiago City National High School, and Sinsayon National High School.

Participants and Sampling Technique

The participants of this study were the Grade 11 teachers assigned to teach Statistics and Probability within the public secondary schools of Santiago City. To select these specific respondents, the researcher utilized a purposive sampling technique. Through this method, a total of 23 Mathematics teachers were intentionally chosen to participate and provide data for the research.

Research Instrument

To gather the necessary data for this study, the researcher primarily utilized a self-made survey questionnaire consisting of two parts: one for determining the demographic profile of the respondents and another for assessing their perceptions regarding the integration of Information and Communication Technology (ICT) in

Statistics and Probability education. The responses in this main questionnaire were measured using a 5-Point Likert Scale, and prior to its actual administration, a try-out was conducted with selected teachers—who were subsequently excluded from the final respondent pool—to ensure the tool's clarity and understandability. In addition to the questionnaire, the researcher employed the interview method to validate the survey responses, conducted random classroom observations to reinforce the gathered data, and utilized documentary analysis to verify the accuracy of the respondents' profile information.

Data Gathering

The data gathering procedure began with the researcher securing permission to conduct the study from the Office of the Schools District Supervisor, followed by seeking approval from the respective school heads to distribute the questionnaires to the teacher-respondents. After obtaining the necessary permits, the survey was prepared in an electronic format and sent directly to the respondents' Facebook Messenger accounts using mobile phones. Ultimately, the researcher achieved a 100 percent retrieval rate because the electronic survey tool was designed so that it could only be submitted and transmitted once all the questions had been fully answered.

Data Analysis

To analyze and interpret the gathered data carefully, the researcher employed specific statistical tools. Simple frequency counts and percentage distributions were used to tabulate and describe the demographic profile of the respondents, such as their age and gender. Furthermore, the weighted mean was utilized to compute and evaluate the respondents' answers across the various sections of the main questionnaire, specifically to quantify their perceptions on the benefits, effects, proficiency levels, and challenges regarding the integration of Information and Communication Technology in instruction.

Ethical Consideration

To ensure the ethical conduct of the research, several protocols were strictly observed throughout the study. Prior to data collection, the researcher sought proper administrative clearance by securing formal permission from the Schools Division Superintendent and the respective school heads. Informed consent and transparency were prioritized; a formal letter was provided to the teacher-respondents explaining the purpose of the study and respectfully requesting their participation. To protect the privacy of the participants, the disclosure of names on the survey questionnaire was made strictly optional, ensuring anonymity. Furthermore, the researcher explicitly guaranteed that all data provided by the respondents would be treated with the highest degree of confidentiality and analyzed with the utmost caution.

RESULTS AND DISCUSSION

The demographic and professional profile of the twenty-three Grade 11 Mathematics teachers reveals that the highest portion of respondents originated from Santiago City National High School. The majority of these educators belonged to the 26 to 30 years old age bracket, were predominantly female, and were already married. Professionally, all respondents specialized in Mathematics, with more than half holding a Master's degree and possessing one to five years of experience teaching Statistics and Probability. Furthermore, most of the teachers occupied a Teacher III position, held an outstanding latest performance rating, and had attended regional-level training seminars.

The integration of Information and Communication Technology (ICT) was perceived highly favorably by the educators. The teachers strongly agreed that ICT provides significant benefits to Statistics and Probability instruction, yielding an overall average weighted mean of 4.72. The most prominent benefits identified were the technology's ability to aid teachers in accessing online academic resources and its capacity to support a student-

centered teaching approach. Correspondingly, the overall effects of ICT on instruction were evaluated as very effective, scoring an average weighted mean of 4.66. The respondents particularly emphasized that ICT makes the mathematics education curriculum significantly more meaningful and establishes a unique characteristic for their teaching strategies.

In terms of technological skill, the teacher-respondents assessed themselves as very proficient in utilizing various ICT tools for teaching Statistics and Probability, registering an overall weighted mean of 4.40. They demonstrated the highest proficiency levels in operating hardware such as projectors, alongside digital communication and presentation tools like emails and PowerPoint. Even the lowest-ranked skill, which was conducting online research, still fell securely within the very proficient classification, indicating a strong baseline of digital literacy among the educators.

Despite the successful integration and high proficiency levels, the respondents evaluated the systemic challenges encountered across three dimensions: school facilities, students, and teachers. With a grand average weighted mean of 1.86, the overall challenges were categorized as least serious. However, among these dimensions, issues pertaining to school facilities posed the most notable difficulties. Specifically, the stability of internet services and the provision of low-speed internet packages were identified as the primary infrastructural bottlenecks limiting instructional potential. Conversely, student-related issues were minimal, and personal challenges for the teachers themselves, such as facing technical problems with software or lacking access to digital resources, were evaluated as not a problem.

CONCLUSION

The study concluded that Information and Communication Technology (ICT) have a profound and positive impact on the instruction of Statistics and Probability among Grade 11 teachers in Santiago City public schools. The key conclusions drawn from the research include:

1. **Enhanced Effectiveness and Engagement:** The utilization of digital platforms and tools has made teaching these subjects significantly more effective, while also greatly improving student comprehension and engagement.
2. **Positive Teacher Perception:** Educators view the digitization of education in a highly positive light. The integration of ICT has made explaining abstract and complex statistical concepts much easier, allowing teachers to provide a more concrete understanding through online simulations and interactive media.
3. **Need for Strategic Resolutions:** Despite the positive transformation, the integration of ICT is not without its challenges. While teachers are generally proficient, there are still variations in the level of ICT skills applied, leading to differences in how these tools are utilized. Furthermore, notable issues regarding digital infrastructure and access persist, highlighting the need for strategic resolutions to ensure equitable and seamless ICT integration across all schools.

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