Original Research Article

Analyzing the Grade 11 Statistics and Probability Curriculum for 21st-Century Skill Alignment: Toward Curriculum Enhancement

ABSTRACT

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| This study examines the alignment of the Grade 11 Statistics and Probability Curriculum Guide with the domains of 21st-century skills using a qualitative content analysis approach. Guided by Tyler’s Model of Curriculum Development and in reference to the Partnership for 21st Century Learning (P21) framework, the analysis focused on examining how skills like critical thinking, teamwork, digital literacy, and life skills are reflected in the curriculum. A coding matrix was employed to classify each learning competency according to its level of alignment— whether clearly (explicit), indirectly (implicit), or not at all—with three core skill domains: Learning and Innovation Skills; Information, Media, and Technology Skills; and Life and Career Skills.  The results show that all the competencies (100%) demonstrated alignment with at least one 21st-century skill, with critical thinking and data literacy being the most emphasized. However, there is little focus on technology-related skills, and Life and Career Skills are not clearly addressed, showing an uneven distribution of skills. While the curriculum supports cognitive development, it falls short in preparing learners for digitally driven and real-world careers. The study recommends curriculum by more clearly including the missing skills, providing teacher training, and regularly reviewing the curriculum to better prepare senior high school students for the future. |

*Keywords: 21st-century skills, curriculum alignment, content analysis, Statistics and Probability, senior high school, Tyler’s curriculum model*

1. INTRODUCTION

In today’s fast-evolving global landscape, driven by rapid technological advancements, globalization, and an expanding knowledge base, the skills required for personal and professional success have grown significantly. Education systems worldwide are now expected to equip learners with a broader set of competencies—commonly referred to as 21st-century skills—which include critical thinking, communication, collaboration, adaptability, digital literacy, and self-directed learning (Trilling & Fadel, 2009; Care et al., 2019).

To meet these demands, countries such as Finland, Singapore, and Australia have restructured their national curricula to explicitly embed 21st-century skills across subject areas. Finland’s National Core Curriculum, for example, incorporates transversal competencies like multiliteracy, ICT competence, and work-life skills (Finnish National Board of Education, 2016). Singapore, through its 21st Century Competencies Framework, integrates values and skills such as civic literacy and critical thinking throughout basic education and teacher training programs (Ministry of Education Singapore, 2015). Similarly, Australia’s General Capabilities Framework ensures that all students develop capabilities such as ICT proficiency, personal and social capability, and intercultural understanding (Scoular, 2020). However, despite these policy-level reforms, research reveals a persistent gap between intended curriculum goals and actual classroom practices. Challenges such as limited teacher training, unclear assessment strategies, and weak curriculum coherence often hinder effective implementation (OECD, 2018; UNESCO, 2020).

In the Philippine context, the introduction of the K to 12 Basic Education Program was a significant move to align the national education system with global standards. Central to this reform is the integration of 21st-century skills across all learning areas, including mathematics subjects such as Statistics and Probability (DepEd, 2016). These subjects aim to develop higher-order thinking, data analysis, and problem-solving skills, which are crucial in academic and real-world contexts. However, despite these intentions, implementation studies suggest gaps in how these skills are articulated, taught, and assessed within the curriculum (Scoular, 2020; UNESCO, 2020).

A critical issue lies in the alignment between the written curriculum and 21st-century learning frameworks. While policies often emphasize future-ready competencies, curriculum documents may not consistently reflect these priorities. Misalignment can result in missed opportunities for students to develop transferable skills, limiting their preparedness for modern work and life demands (Bernstein, 2020; Saavedra & Opfer, 2012). Additionally, unclear curricular foundations may pose challenges for educators in designing instruction and assessments that effectively foster these skills.

Despite the growing emphasis on 21st-century competencies in Philippine education, there remains a lack of empirical studies examining curriculum documents, particularly in senior high school mathematics. This study addresses that gap by conducting a qualitative content analysis of the Grade 11 Statistics and Probability Curriculum Guide. Guided by Tyler’s Model of Curriculum Development and informed by the Partnership for 21st Century Learning (P21) framework, the study examines the extent to which core 21st-century skills are integrated into the prescribed learning competencies. The findings aim to inform curriculum refinement and teacher preparation, ensuring a stronger alignment between academic instruction and the broader goal of producing globally competent, future-ready Filipino graduates.

***Statement of the Problem***

This study aims to analyze the alignment between the Grade 11 Statistics and Probability Curriculum Guide and the essential competencies defined by 21st-century learning framework. Specifically, it seeks to answer the following questions:

* What 21st-century skills are reflected in the learning competencies of the Grade 11 Statistics and Probability curriculum?
* To what extent are these skills explicitly or implicitly integrated in the curriculum?
* What gaps, if any, exist between the curriculum content and the core components of 21st-century skill frameworks?
* Based on the findings, what curriculum enhancement program can be proposed to strengthen the integration of 21st-century skills in Grade 11 Statistics and Probability?

***Fig 1-Conceptual Framework***

***Theoretical Lens***

This study is grounded in Ralph Tyler’s Model of Curriculum Development. Tyler (1949) proposed that curriculum planning should be based on four key questions: (1) What educational goals should schools aim to achieve? (2) What learning experiences can help students reach these goals? (3) How should these experiences be organized for effective learning? and (4) How can we know if the goals have been achieved? At its core, Tyler’s model stresses the importance of aligning learning objectives, teaching strategies, and assessment tools to ensure meaningful and goal-oriented instruction.

In the context of this study, Tyler’s model serves as a framework for examining whether the Grade 11 Statistics and Probability Curriculum is intentionally structured to develop essential 21st-century skills. Using content analysis, the research explores how well the curriculum integrates competencies such as critical thinking, collaboration, problem-solving, and digital literacy. Tyler’s emphasis on aligning curriculum objectives with societal needs directly supports the focus of this research, which seeks to ensure that students are being prepared for the realities and challenges of the 21st century.

2. METHOD

This study used a qualitative research design, specifically content analysis, to examine how well the Grade 11 Statistics and Probability Curriculum Guide supports the development of 21st-century skills. Content analysis is a systematic method of studying written or printed materials by identifying recurring themes, patterns, and meanings (Krippendorff, 2018). In the context of education research, content analysis is particularly useful for examining curriculum documents to assess the presence and emphasis of educational goals and competencies (Bowen, 2009). This study aims to analyze the Grade 11 Statistics and Probability Curriculum Guide to determine how well it aligns with 21st-century skills.

The research was conducted using the official Grade 11 Statistics and Probability Curriculum Guide issued by the Philippine Department of Education (DepEd). This document outlines what students are expected to learn through its content standards, performance standards, and learning competencies. It serves as the authoritative document that teachers use in planning and delivering instruction as mandated by the Department of Education (DepEd). The curriculum was selected for analysis because of its foundational role in promoting data literacy, statistical thinking, and decision-making among senior high school learners—skills that are considered essential in the 21st century.

The data source consisted solely of this curriculum guide, retrieved from DepEd’s official repository to ensure its validity. Since the study involves document analysis, no human participants were involved, and no field-based data (such as classroom observations or student interviews) were collected. The study followed a purposive sampling approach, where the document was specifically chosen based on its relevance to the research objectives. This sampling strategy aligns with the goal of in-depth qualitative examination, which prioritizes depth and relevance over generalizability (Merriam & Tisdell, 2016).

The data collection and analysis process followed a structured and transparent procedure. First, the researcher carefully reviewed the curriculum guide to extract all learning competencies. A coding matrix was then developed using established 21st-century skills frameworks, particularly those from the Partnership for 21st Century Learning (P21, 2019) and UNESCO (2016). Each learning competency was then analyzed and coded into one of three alignment categories: explicitly aligned (directly referencing a 21st-century skill), implicitly aligned (suggestive of a skill without naming it), or not aligned (no visible reference to any 21st-century skill), within the context of the three major domains:

* Learning and Innovation Skills (e.g., critical thinking, communication, collaboration, creativity),
* Information, Media, and Technology Skills (e.g., digital literacy, media analysis),
* Life and Career Skills (e.g., adaptability, responsibility, leadership).

To enhance objectivity and reliability, coding results were peer-reviewed by a second curriculum researcher. To reduce subjective bias and improve the consistency of our interpretations, all coding disagreements were collaboratively discussed and resolved.

To analyze the data, the researcher used descriptive and thematic content analysis techniques. Descriptive analysis was used to quantify the frequency of each 21st-century skill represented in the curriculum, while thematic analysis was applied to identify qualitative patterns in how the skills were embedded. According to Braun and Clarke (2006), thematic analysis offers a structured way to identify and report patterns in qualitative data. The findings were presented in the form of summary tables, sample coded excerpts, and narrative interpretations based on recurring themes.

Although the study did not involve human participants, ethical standards were strictly observed. The curriculum guide used is a publicly available government document and was appropriately cited. All interpretations were conducted transparently and with academic integrity. To ensure the trustworthiness of the findings, the study employed several qualitative rigor strategies: peer debriefing during coding validation, description of the coding matrix and procedures, and theoretical triangulation through multiple frameworks (Tyler’s model, P21, UNESCO) (Lincoln & Guba, 1985). These steps reinforced the credibility, dependability, and confirmability of the results and recommendations.

Ultimately, this methodological approach was not only aimed at describing the current state of curriculum alignment but also intended to generate practical and useful insights leading to curriculum enhancement. By identifying gaps in the inclusion of 21st-century skills, the study provides a foundation for revising learning competencies, improving instructional planning, and informing policy decisions. The aim is to create a senior high school mathematics curriculum in the Philippines, particularly for statistics and probability, that better reflects current needs and prepares students for the future.

3. results and discussion

This chapter presents the results of the content analysis conducted on the Grade 11 Statistics and Probability Curriculum Guide issued by the Department of Education. The analysis focused on identifying the alignment of learning competencies with 21st-century skills using a coding matrix using the frameworks from the Partnership for 21st Century Learning (P21) and UNESCO. Each competency was categorized as explicitly aligned, implicitly aligned, or not aligned with three skill domains: Learning and Innovation Skills, Information, Media, and Technology Skills, and Life and Career Skills.

**Table 1. Distribution of 21st-Century Skill Domains Across Curriculum Competencies**

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| **Skill Domain** | **Number of Competencies** | **Percentage** | **Remarks/Description** |
| Learning and Innovation | 55 | 100% | Evident through tasks involving problem-solving, data analysis, and statistical reasoning. |
| Information, Media, and Technology | 8 | 14.5% | Present in competencies related to data interpretation, modeling, and graphical representation. |
| Life and Career | 0 | 0% | Not explicitly present; real-life context appears but lacks direct phrasing aligned with core skills. |

These figures suggest that while Learning and Innovation Skills are well-represented, there is a lower integration of Information, Media, and Technology Skills, and a lack of explicit integration of Life and Career Skills, primarily as the competencies are stated. Although certain competencies address practical scenarios such as “real-life problems”, it was stated so that in a manner that does not directly correspond with the dimensions of Life and Career Skills. (e.g., self-direction, adaptability, responsibility) as defined by P21/UNESCO frameworks without significant inference.

**Table 2. Alignment of Grade 11 Statistics and Probability Competencies with 21st-Century Skills**

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| **Level of Alignment** | **Number of Competencies** | **Percentage** |
| Explicitly Aligned | 37 | 67.3% |
| Implicitly Aligned | 18 | 32.7% |
| Not Aligned | 0 | 0% |
| **Total** | **55** | **100%** |

These results indicate a high degree of integration of 21st-century skills within the curriculum, particularly in the domains of critical thinking, problem-solving, and data literacy.

Sample Competency Alignments:

* "solves problems involving mean and variance of probability distributions." (M11/12SP-IIIb-4) – Explicitly aligned with Problem-Solving and Critical Thinking (Quantitative Reasoning).
* "constructs the probability mass function of a discrete random variable and its corresponding histogram." (M11/12SP-IIIa-5) – Explicitly aligned with Creativity (Construction/Representation) and can implicitly involve Digital Literacy if using software.
* "identifies the parameter to be tested given a real-life problem." (M11/12SP-IVa-3) – Explicitly aligned with Critical Thinking (Problem Identification) and Problem-Solving (Contextualization)
* "draws conclusion about the population mean based on its confidence interval estimate." (M11/12SP-IIIh-3) – Explicitly aligned with Critical Thinking (Interpretation, Decision Making).

These examples reflect the curriculum’s capacity to embed high-level reasoning skills across content areas.

The content analysis of the Grade 11 Statistics and Probability curriculum found that Learning and Innovation Skills are fully integrated, appearing in 100% of the competencies. This complete integration highlights the curriculum's strong commitment to developing the kind of higher-level thinking that's fundamental for 21st-century learning (Care et al., 2019; Scoular, 2020). These findings indicate that the curriculum effectively supports intellectual engagement and analytical reasoning, aligning well with international education standards. However, though there is complete integration of one of the core competencies, there is a notable uneven distribution of other essential 21st-century skills. Specifically, Information, Media, and Technology Skills were present in only 14.5% of the competencies, and Life and Career Skills were not found to be integrated in any of the competencies. This imbalance suggests that while the curriculum promotes cognitive depth, it may fall short in equipping learners with the broader range of competencies needed in today's workforce and society (UNESCO, 2016; Trilling & Fadel, 2009).

In terms of how well the curriculum aligned with 21st-century skills, 67.3% of the learning competencies were found to be explicitly aligned with at least one core competencies, while 32.7% were implicitly aligned. None of the competencies were found to be entirely misaligned. This high proportion of explicit alignment reflects deliberate curriculum design and supports the claim that Philippine mathematics education incorporates modern competencies, particularly in analytical and applied domains (Tyler, 1949; Bernstein, 2020). Competencies and tasks in relation to data interpretation, hypothesis formulation, and probability estimation demonstrate a clear intention to develop competencies that go beyond rote computation. This shift is aligned with current global educational trends, which advocate for conceptual understanding and real-world application over procedural learning (OECD, 2018; NCTM, 2014).

Despite these strengths, the study underscores clear areas for improvement. The most pressing need is the explicit incorporation of digital tools, media literacy, and collaborative life-relevant contexts within these competencies. While some reference real-life problems, they often lack direct connections to important life and career competencies such as teamwork, adaptability, and self-direction. These are vital skills emphasized in both the Partnership for 21st Century Learning (P21) framework and UNESCO’s Future of Education agenda (UNESCO, 2020; World Economic Forum, 2020). Their limited presence in the curriculum is a missed opportunity to prepare students not just as learners, but as flexible, socially responsible citizens and future professionals.

Furthermore, the absence of Life and Career Skills might reduce students' readiness to apply mathematical ideas in real-world, civic, or work-related situations. Without opportunities to practice leadership, take initiative, or make decisions within mathematical problems, students might struggle to see how these skills matter beyond the classroom. Embedding these competencies into performance tasks, such as designing data-driven projects, understanding social trends through statistics, or simulating business scenarios, could bridge this gap (Saavedra & Opfer, 2012). Such changes would also help students transfer their skills more easily, which is becoming increasingly vital in today's unpredictable and fast-changing job markets.

In conclusion, while the Grade 11 Statistics and Probability curriculum strongly supports core cognitive skills, it doesn't yet fully integrate the entire range of 21st-century competencies. To address this gap, the curriculum shall be enhanced by focusing on digital literacy, collaborative learning opportunities, and tasks that prepare students for real life. These findings highlight the ongoing need for curriculum review, focused professional development for teachers, and broader changes in how we teach. This will ensure that our learners are not only strong academically but also well-prepared for the demands of a modern, interconnected world.

The study found that the Grade 11 Statistics and Probability curriculum demonstrates strong alignment with core Learning and Innovation Skills, notably in fostering critical thinking, problem-solving, and analytical reasoning. This aligns with its goal of preparing students for complex cognitive challenges and meets global education standards. However, we also found notable gaps: Information, Media, and Technology Skills are not explicitly integrated enough, and, more critically, Life and Career Skills are totally absent. These deficiencies could limit the curriculum's effectiveness in fully preparing students for modern workplaces, digital environments, and practical decision-making.

Using Tyler’s Model of Curriculum Development as reference, which emphasizes purposeful, outcome-based learning, which emphasizes learning with clear purposes and outcomes, our findings underscore the need for continuous curriculum refinement. This refinement is crucial to ensure that all desired outcomes—especially those related to employability, adaptability, and global citizenship—are thoroughly addressed in both what is taught and how it is taught. Without balanced integration of all domains of 21st-century skills, learners might develop only partial competencies, reducing the curriculum's long-term relevance and impact.

4. Conclusion

Based on the findings of this study, it is strongly recommended that curriculum developers, education policymakers, and senior high school mathematics educators should collaborate to address the observed gaps in the integration of 21st-century skills within the Grade 11 Statistics and Probability curriculum. While the curriculum effectively promotes Learning and Innovation Skills like critical thinking and problem-solving, there's a clear need to boost the presence of Information, Media, and Technology Skills and, even more urgently, Life and Career Skills. These skills are vital for preparing students not only for academic success, but also to be adaptable and productive in our modern, rapidly changing global environment.

To address these gaps, this study proposes the implementation of the SP21 Enhancement Framework (Statistics and Probability for the 21st Century Learner). This comprehensive model is designed to integrate all domains of 21st-century skills directly into the curriculum's content, teaching methods, and assessment practices. The framework comprises five interconnected components, each playing a vital role:

* First, integrating modern digital tools. Bring spreadsheet applications, data visualization software, simulations, and other educational technologies directly into lessons. The aim is to boost students' digital literacy, preparing them to confidently navigate and work with the data-rich world around them.
* Second, set a “Real-World Project Bank” that offers a collection of hands-on, performance-based tasks rooted in authentic scenarios, such as analyzing health trends, business data, or environmental challenges. These tasks are designed to help students connect statistical ideas to everyday decision-making, encourage their participation in civic life, and better prepare them for future careers.
* Third, provide sample lesson plans and learning sequences that explicitly weave in collaboration, creativity, communication, and leadership skills. These guides are designed to be easily integrated into existing teaching routines while making the subject more relevant to the learner’s lives.
* Fourth, create and deliver specialized training modules for teachers, perhaps through professional learning communities or in-service programs. These modules will focus on instructional strategies for fostering 21st-century skills, using technology effectively in the classroom, and designing inclusive, performance-based learning experiences.
* Lastly, there shall be an assessment redesign tool such as rubrics, self-assessments, and peer evaluations should be created to assess not only content mastery but also students’ development of transferable competencies like initiative, adaptability, and collaboration.

In addition to adopting this framework, it is recommended that the Department of Education establish regular, collaborative and participatory curriculum reviews. This process should involve educators, curriculum experts, industry professionals, and learners themselves to ensure that the curriculum remains responsive to changing societal and labor market demands. Furthermore, future research should explore how 21st-century skills are integrated across other senior high school subjects. This would provide a clearer picture of system-wide alignment and help inform broader educational reforms.

By implementing these recommendations, the Philippine basic education system can move beyond simply covering content leading toward holistic learner development. By embedding transferable, real-world competencies into the Statistics and Probability curriculum, we can ensure that Filipino students are not only mathematically strong but also exceptionally well-prepared for the challenges of higher education, future employment, and active, engaged citizenship in the 21st century.

Consent

As the sole author, I declare that no informed consent was required for this study, as all data was gathered from a publicly available document.

Ethical approval

No ethical approval was necessary for this research, as all data was extracted from a publicly accessible document.

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