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Information and Communication Technology Competency and Teachers' Higher-Order Thinking Skills

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Abstract: In today's digital age, integrating Information and Communication Technology (ICT) into education is critical for improving teaching and learning processes. Understanding this connection is vital for developing ways to improve technology competency and critical thinking capabilities in educational contexts. The main goal of the study is to determine the relationship between teachers' ICT Competency and their higher-order thinking skills in the Villanueva South District, Division of Misamis Oriental. It sought to answer the level of teachers' ICT competency, the teachers' assessment of their higher-order thinking skills, and the significant relationship between the level of ICT competency and the teachers' higher-order thinking skills. The responders comprised the total complete population of one hundred fifty (150) teachers. The collected data was analyzed using frequency, percentage, mean, and standard deviation. The research instrument was a standardized questionnaire based on the National ICT Competency Standards for Teachers (NICS) and Limback and Waugh's higher-order thinking skills questionnaire. The findings show that teachers display various ICT competencies, including strong capabilities in addressing ethical concerns associated with technology, which is critical for developing secure digital learning environments. However, there is a clear need for greater technical integration in teaching techniques, particularly when developing defined learning objectives. The study found a significant correlation between teachers' professional ICT abilities and their capacity to nurture higher-order thinking, underlining the necessity of focused professional development for improving instructional effectiveness and promoting critical thinking. Recommendations to strengthen technology's role in education and improve teachers' higher-order thinking skills include putting collaborative training approaches into practice, aligning school policies and resources to support technology-enhanced education, encouraging collaborative cultures, creating technology integration teams, and inviting community partners.

Keywords **- *Keywords* - Information and Communication Technology, Competency, Higher-Order Thinking Skills**

I. INTRODUCTION

Information and communication technology (ICT) integration has become a revolutionary force in the modern educational environment, changing established teaching and learning paradigms. It has assimilated into advanced life in little more than a decade. We need well-equipped teachers to facilitate students' learning with technology as schools prepare pupils to function in a society and industry heavily reliant on technology. However, many of today's teachers grew up in a period of change and vary in their ability and comfort with the wealth of technology resources at their disposal. Their ability to use technology to improve student learning and students' technological skills depends partly on how comfortable they use technology in their personal lives outside of the classroom. Beyond that, their confidence in their capacity to do so successfully affects their incentive to integrate ICT into education rather than more conventional modes of pedagogy with which they may be more experienced.

Traditional educational approaches cannot meet the diverse demands of today's pupils due to the rapid technological advancements of the 21st century. This has led to a shift in ideas toward integrating digital tools into the teaching and learning process. Like many other educational districts worldwide, the Villanueva District teachers struggle to strike a balance between traditional teaching approaches and the demands of digital technology. There is an urgent need to effectively incorporate ICT tools into education, in keeping with global trends that emphasize the importance of digital literacy, critical thinking, and collaborative skills in educating pupils for a fast-changing world.

Further, teachers play a critical role in enabling learning experiences that provide students with the skills learners need to prosper in an information-rich society. To successfully integrate technology into the classroom, educators must be able to use technology tools to boost engagement, foster critical thinking, and adapt varied learning styles. The extent to which instructors incorporate technology throughout their lesson planning heavily depends on their self-efficacy, indicating their comfort with utilizing ICT tools.

Understanding this relationship is important for improving pedagogical techniques inside the district and contributing to the larger conversation about technological integration in education. This study intends to highlight avenues for establishing a harmonic synergy between technological innovation and effective education by unraveling the complications and distinctions that determine instructors' attitudes and behaviors regarding technology integration.

The quality of education is greatly impacted by the dynamic interplay between teachers' higher-order thinking skills and their information and communication technology expertise. IT-savvy teachers are in a better position to incorporate technology into their lesson plans with more ease, creating an atmosphere that encourages pupils to develop higher-order thinking abilities. With the use of ICT, educators may create dynamic, interesting learning environments that foster creativity, critical thinking, and problem-solving.

Furthermore, educators possessing advanced ICT abilities frequently demonstrate increased flexibility when utilizing digital resources, establishing cooperative learning environments, and putting creative assessment techniques into practice. The relationship that exists between higher-order thinking skills and ICT competency highlights how important technology is to the development of contemporary education and the preparation of students for the complexity of the knowledge landscape of the twenty-first century.

The core of this research is the teachers' competence and their higher-order thinking skills to successfully integrate ICT technologies into their teaching strategies. The goal of this study was to conduct a thorough investigation of the relationship between ICT competency and teacher's higher-order thinking skills in Villanueva South District. Hence, understanding the link between ICT competency and higher-order thinking skills might help explain how technology integration in education affects teaching pedagogy. It can assist in identifying opportunities for teachers to use technology to encourage critical thinking, problem-solving, and analytical skills in their students.

II. RESEARCH METHODOLOGY

The study made use of the descriptive survey method of research designed to identify and disseminate existing phenomena with the established objectives and objectives. This study is well-suited for quantitative research because it involves the precise measurement of two variables: ICT competence and teacher's higher-order thinking skills. These variables were quantified using numerical scales or scores. ICT competency was measured through a standardized questionnaire, while a teacher's higher-order thinking skills were assessed using ratings, or scores based on specific criteria outlined in the competency standards.

2.1Population and Sample

The respondents of the study were all the teachers of Villanueva South District. The researcher utilized the total population of the ten (10) schools under Villanueva District with a population of one hundred fifty (150) teachers. These comprised Teacher 1 to Master Teacher 2 positions in all grade levels of Elementary, Junior High School, and Senior High School. These teachers of each year level aspire to improve computer skills and higher-order thinking skills.

2.2 Data and Sources of Data

The researcher used the Philippine National Standards ICT Competency Standards for teachers created by the Commission on Information and Communication Technology, which has been changed to the Department of Information and Technology. This covers four domains namely: technology operations and concepts, social and ethical considerations, pedagogical considerations, and professional. This was used to measure the ICT-level Competency skills of teachers in the Villanueva District.

In evaluating the teacher's higher-order thinking skills, the researcher used the questionnaire on Higher-Order Thinking Skills which was adapted from the study of Limback and Waugh (2010) and modified by the researcher. There are five steps, namely: formulation of learning objectives, teach through questioning, practice before assessment, review, refine and improve and feedback and assessment of learning.

The instrument's reliability indicated that the questionnaire consistently measures the same construct across different items and demonstrates strong internal consistency based on Cronbach's alpha values ranging from 0.920 to 0.962, indicating that the instrument was highly reliable. This suggested that the questionnaire consistently evaluated the same construct across different items and had excellent internal consistency. The strong alpha values indicated that the instrument was reliable and trustworthy for evaluating a teacher's higher-order thinking skills. Furthermore, the instrument's dependability was confirmed by testing on a separate group of thirty (30) teachers from Vicente N Chavez Memorial Central School, Villanueva North District who were not part of the main study, strengthening its reliability. The test was conducted last November 13, 2023, before the conduct of the study.

2.3 Theoretical framework

Cognitive Theory examines the mental processes involved in learning and problem-solving, focusing on how people understand, process, and remember information. In the ICT (Information and Communication Technology) competency context, cognitive theory sheds light on how teachers learn technical abilities and incorporate them into their teaching methods. Understanding these cognitive processes is critical for determining teachers' mental operations while employing ICT tools to promote HOTS in their students. Regarding teachers' ICT proficiency and higher-order thinking skills it is vital to investigate how cognitive theory and Bloom's Taxonomy intersect to assist the development of these competencies.

2.4Statistical tools and econometric models

The independent and dependent variables used the descriptive-correlational research approach, which documented, evaluated, and interpreted data about respondents' ICT competencies. The descriptive research describes statistics on frequencies, percentages, and mean scores obtained by evaluating survey data. The Pearson-r Moment Coefficient was utilized to determine the significant association between the two variables. Descriptive-correlational research investigations were designed to collect correct

information about phenomena, draw broad conclusions from the data acquired, and draw reliable and comprehensive conclusions from the facts revealed.

3.4.1 Descriptive Statistics

Having collected and recorded the data gathered in the study, the researcher used the following statistical tools. Descriptive statistics such as frequency, percentage, mean, and standard deviation will be used to describe the variables in the study. Moreover, Pearson Product Moment Correlation was used to determine a significant relationship between ICT competency and the teacher's higher-order thinking skills.

III. RESULTS AND DISCUSSION

3.1 Table 1: Summary of the Level of Respondents' ICT Competency

Variable	Mean	SD	Interpretation
Technology Operations and Concepts	3.91	1.05	Advance
Social and Ethical	3.94	0.97	Advance
Pedagogical	3.79	1.01	Advance
Professional	3.31	1.12	Proficient
Overall	**3.74**	**1.04**	**Advance**

Table 1 shows a summary of overall **ICT competency** among public school teachers with an overall mean score of 3.74 (SD=1.04), interpreted as **Advance** .A standard deviation indicates that, while the average teacher is at the advanced level, there is some variation in competence between teachers. This means they had advanced skills in technology operations and devices, social and ethical considerations, pedagogical strategies, and professional development related to ICT. This was consistent with the findings of Treceñe (2021), which highlighted the need for improvement in ICT skills among teachers.

The variable **Social and Ethical** got the highest mean of 3.94 (SD=0.97), interpreted as **Advance.** A standard deviation indicates that, while the average teacher is advanced in understanding and applying social and ethical factors while using ICT, there is some variation in proficiency levels across teachers. However, this high mean indicates that teachers were particularly advanced in understanding and applying social and ethical considerations when using ICT. They were likely adept at navigating issues such as online safety, digital citizenship, and ethical use of technology. This suggests that the teachers were technically advanced and socially responsible in their ICT practices. This finding aligned with Mata et al.'s (2021) study, which highlighted the importance of addressing ethical concerns in ICT use and the need for training programs to promote ethical practices among educators.

On the other hand, the variable **Professional** got the lowest mean of 3.31 (SD=1.12), interpreted as **Proficient**. A standard deviation indicates that the scores for the "Professional" domain is distributed around the mean score of 3.31, indicating a wide variety of competency levels among instructors in integrating ICT into their professional practices. This implies that teachers may have needed further training or support in areas such as integrating ICT into their teaching practices, staying updated on new technologies, or effectively collaborating with colleagues on ICT-related initiatives. Similarly, the result of the study of Mijares (2022) recommended that teachers must increase their level of competence in the Professional Domain to become more proficient and effective in carrying out their duties and responsibilities and that these can be accomplished through seminar workshops on professional growth and development, research, innovation, and collaboration simultaneously maximizing their ICT skills from that of a competency-based training program provided.

3.2 Table 2: Summary of the Level of Respondents' Higher-Order Thinking Skills

Variables	Mean	SD	Interpretation
Formulation of Learning Objectives	3.18	0.61	High
Teach through Questioning	3.28	0.61	Very High
Practice Before Assessment	3.22	0.61	High
Review, Refine and Improve Process	3.19	0.60	High
Feedback and Assessment of Learning	3.19	0.65	High
Overall	**3.21**	**0.62**	**High**

Table 2 summarizes the **higher-order thinking skills** among public school teachers with an overall mean of 3.21 (SD=0.62), interpreted **High.** The standard deviation of 0.62 illustrates the degree of variation in teachers' practice scores around the mean score of 3.21 for higher-order thinking skills. It indicates teachers' consistency and overall success in incorporating these abilities into their teaching techniques, which positively impacts student learning results. This aligned with research suggesting that HOTS were crucial for advancing learning and critical thinking abilities (Singh et al., 2018).

The variable **Teach through Questioning** got the highest mean score of **3.28 (SD=0.61**), interpreted as **Very High.** This means that teachers consistently use questioning techniques to promote critical thinking and problem-solving among students. The standard deviation of 0.61 represents the degree of variation in instructors' practices around the mean score of 3.28 for this domain. It demonstrates teachers' consistency and success in using questioning strategies to promote critical thinking and problem-solving skills among students. This implies that teachers were adept at engaging students in higher-order thinking activities through

questioning, fostering deeper understanding and application of knowledge. This finding was supported by research emphasizing the role of questioning in stimulating critical thinking and promoting higher-order thinking skills among students (Antonio & Prudente, 2024).

On the other hand, the variable **Formulation of Learning Objectives** obtained the lowest mean score of 3.18 (SD=0.61), interpreted as **High**. The low standard deviation of 0.61 demonstrates consistency in teachers' ability to develop learning objectives about higher-order thinking capabilities. Most teachers show comparable levels of ability in this area. Teachers may have benefited from additional training or support in this area to enhance their ability to design learning experiences that effectively promote higher-order thinking skills, as emphasized by Bloom's Revised Taxonomy of Cognitive Objectives (Blooms, 2019).

3.3Table 3: Summary of the Test on Relationship Between Teachers' ICT Competency and their Higher-Order Thinking Skills

Correlation		**Teacher's Higher-Order Thinking Skills**					**Overall**
ICT Competency		Formulation of Learning Objectives	Teach through Questioning	Practice Before Assessment	Review, Refine and Improve	Feedback and Assessment of Learning	
Technology Operations and Concept	r-value	0.320**	0.417**	0.360**	0.356**	0.407**	**Significant**
	Relationship Strength	Weak	moderate	Weak	Weak	Moderate	
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	
Social and Ethical	r-value	0.404**	0.481**	0.437**	0.430**	0.474**	**Significant**
	Relationship Strength	Weak	Moderate	Moderate	Moderate	Moderate	
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	
Pedagogical	r-value	0.401**	0.498**	0.459**	0.434**	0.480**	**Significant**
	Relationship Strength	Weak	Moderate	Moderate	Moderate	Moderate	
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	
Professional	r-value	0.383**	0.461**	0.469**	0.501**	0.507**	**Significant**
	Relationship Strength	Weak	Moderate	Moderate	Moderate	Moderate	
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	

Table 3 illustrates the association between ICT competency and higher-order thinking skills among public school teachers. Overall, the findings revealed a significant positive relationship between teachers' ICT competency level and higher-order thinking skills across multiple domains, including technology operations and concepts, social and ethical aspects, pedagogical practices, and professional development. The Pearson Correlation Coefficient (r) measured the strength and direction of these associations, with values ranging from 0.410 to 0.513, indicating a moderate positive correlation. Furthermore, all p-values were less than 0.001, showing that the correlations were statistically significant. Specifically, the professional domain had the strongest overall correlation, showing a fairly significant association (r= 0.513**, p = <0.001). This revealed that teachers with greater levels of professional ICT proficiency were more likely to engage in higher-order cognitive processes such as developing learning objectives, providing feedback, and evaluating learning outcomes. This finding suggested that investing in professional development programs to increase teachers' ICT skills could lead to improving their capacity to engage students in critical thinking and problem-solving activities.

Moreover, according to the research findings, teachers' proficiency with technological operations and concepts has a weak to moderate effect on their ability to think more critically at a higher level. This is especially true when creating learning objectives, guiding students via questioning, and providing feedback and assessment. While not very strong, the correlation values (r=0.417**) for teach through questioning and 0.320 for learning objective formulation) are statistically significant ($p < 0.001$), indicating that even a minimal level of technical proficiency can moderately improve the cognitive complexity with which teachers approach learning objectives and classroom interactions. Improving teachers' proficiency in this domain could result in more successful technology integration in pedagogy, creating an atmosphere that supports the growth of students' higher-order thinking abilities. This finding aligned with the study conducted by Singh et al. (2018), which emphasized the essential role of higher-order thinking skills (HOTS) in advancing students' learning and critical thinking abilities. Singh et al.(2018) asserted that prior knowledge of subject matter content was fundamental for students to think critically and effectively utilize HOTS when encountering challenges or uncertainties.

On the other hand, for all evaluated higher-order thinking processes, the ICT competency Social and Ethical domain demonstrates a stronger, moderate association (r=0.481**) for inquiry-based instruction and (r=0.491**) for evaluation and feedback. This shows that teachers are better at engaging students in complex decision-making processes and ethical reasoning—crucial components of higher-order thinking—when they successfully include social and ICT ethical issues into their teaching practice. Thus, training in this area may be essential to equip teachers to lead more complex and contextually rich discussions and assessments in the classroom.

The moderate correlations between the formulation of learning objectives (r=0.401**) and feedback and assessment of learning (r=0.501**) observed in all HOTS processes suggest that pedagogical ICT competency substantially impacts a teacher's capacity to create learning settings that support students' development of higher-order cognitive skills. Strong connections with feedback and evaluation and teaching through questioning are important, indicating that advanced pedagogical practices enhanced with ICT can significantly improve the efficacy and dynamism of learning interactions and assessments. This emphasizes the need for targeted professional development initiatives to enhance educators' use of ICT for deeper cognitive engagement.

Every combination of the research findings above emphasizes the critical role that comprehensive ICT competencies play in raising instructional standards and developing higher-order thinking skills. Professional development programs focusing on these abilities can lead to more effective teaching approaches that enable students to think critically, solve problems, and make decisions.

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