Information and Communications Technology Curricular Offerings in the K-12 STEM: Inputs for a Program Plan

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ABSTRACT

The findings of this study are crucial, as they might potentially be used as a foundation for creating educational curricula in Information and Communications Technology (ICT) for the K–12 STEM education. The research emphasizes the significance of customizing ICT program planning to address the different perspectives and challenges faced by various stakeholders in ICT curricular offerings in the K–12 STEM education. Curriculum specialists, school administrators, faculty members, and students all have similar viewpoints when it comes to the ICT curriculum offerings.

The study has developed two separate concepts for the suggested inputs to develop a comprehensive framework for ICT program planning. The inputs included identifying the problem, sorting the parts into groups, defining the program's inputs, setting goals and objectives, figuring out what the expected program outcomes would be, making an effective implementation strategy, figuring out who the key stakeholders were, deciding how long the program would last, setting up a strong monitoring and evaluation system, and getting the money that was needed.

Furthermore, the school's evaluation of effectiveness, as measured by students' accomplishments in MIL (Media and Information Literacy) and EMPTECH (Empowerment Technology), demonstrates notable achievement in imparting knowledge and skills in these disciplines. The correlation analysis between the evaluation of knowledge and abilities and the effectiveness level of the school yields interesting results, highlighting a positive correlation between evaluation scores and students' General Weighted Average (GWA).

The study provides valuable insights into the problems and difficulties encountered by participants in ICT curriculum offerings in K–12 STEM. The respondents generally have a positive perception of the ICT curricular offerings, with little variation identified across different stakeholder groups.

These findings offer a comprehensive framework for program planners, educators, and policymakers seeking to enhance ICT programs in K–12 STEM education. The study emphasizes the significance of tailored approaches and ongoing assessment in meeting the diverse needs of individuals engaged in K–12 STEM ICT education. As a result, this finally leads to the development of ICT programs that are more efficient and adaptive.

INTRODUCTION

The Department of Education created the K–12 Curriculum in 2012 under Republic Act 10533, the 2013 Enhanced Basic Education Act. DepEd taught academic, vocational, athletic, and arts and design. There are four more academic tracks. These are STEM, ABM, HUMSS, and GA.

Academic STEM topics were more advanced than others. Stehle and Peters-Burton (2019) say STEM education globally prepares students for the profession by fostering 21st-century abilities like communication, cooperation, problem-solving, creativity, and critical thinking.

The Philippine National Research Council reported 4,269 active enlisted scientists in 2023. Engineering and Industrial Research receive 16.96% of STEM degrees, behind Biological Science (18.79%). National Capital

Region scientists number 1,452 (34.57%). Second was Region IV-A (CALABARZON) with 671 active scientists (15.98%).

In January 2023, the Philippines Statistics Authority reported 2.37 million unemployed, or 4.8%. The 2022 unemployment rate jumped 6.4%. From October 2022 to January 2023, accommodation and food service, wholesale and retail commerce, motor car and motorcycle maintenance, public administration and defense, obligatory social security, transportation and storage, and ICT had the biggest quarter-on-quarter employment rise.

In relation, the mobile internet has accelerated worldwide collaboration and automated jobs since the epidemic. Companies and nations seeking growth and investment will prioritize STEM-related fields with basic IT capabilities in fast-growing industries. Due to rapid technological change, K–12 STEM ICT curricula may not equip students for work this was based on the article published in the International Trade Administration website by Giray (2022).

Education must improve complex technology skills to suit corporate and worker needs. K–12 STEM ICT programs require evaluation and enhancement. Education and work must incorporate technology (Hara, 2023).

As technology, innovation, and research rise, there is a growing need for STEM professions. Digitizing multinationals offers STEM jobs. These global careers address AI, automation, and sustainability. These positions provide biotech, cybersecurity, and renewable energy jobs. Career advancement and impact are possible in these positions (Almirino et al., 2020).

K–12 STEM and ICT classes must change. Prioritizing STEM and ICT education is crucial. In ICT training, educators must address labor requirements, new technologies, and digital skills. STEM should prioritize technology since research demonstrates it affects teaching and learning. STEM education occasionally prioritizes science and math above engineering and IT. Technology-based STEM instruction increases topic adaptability and efficacy (Quijano, 2023).

Empowerment Technology and Media Information Literacy, K–12 STEM ICT courses, emphasize user skills and computer and application theory over ICT design and development (Tuscano, 2019).

This study analyzed the issues experienced by the respondents in the current K–12 STEM ICT curriculum offerings and used the results as the basis for developing inputs for the ICT program plan. The technology curriculum includes learning outcomes, assessment, instruction, and resources. The study evaluated and recommended ICT course improvements.

BACKGROUND OF THE STUDY

Quijano (2023) found that Philippine K–12 STEM education promotes theories over technology skills, which are necessary for STEM engineering.

This suggests that the gap between industry technical skill requirements and workers' technologically acquired skill needs will expand in the future. Shifting the STEM curriculum from ICT-focused to rigorous computer science principles will close the gap. His findings suggested that students learn more than computer use. Tuscano (2019) suggests teaching algorithms, data structures, computing, programming, artificial intelligence, robotics, and mechatronics.

Due to the pandemic, our education system has changed substantially in the past two years. Educational technology has developed and become more evident, enabling positive and inclusive education for all. Technology has transformed classrooms and school management, says DepEd Undersecretary Pascua (2020).

In this regard, Sedaghatjou et al. (2023) also observed that technology integration is now standard for learning and other educational processes.

In addition, school administrators, teachers, students, and other personnel are familiar with technology in school procedures (Rafanan et al., 2020). Given that, the Researcher decided to develop STEM-strand academic track schools' ICT curriculum. Technology is rapidly changing education.

Badmus (2023) thought technological literacy went beyond computer and software knowledge. It envisions each student knowing technology's existence, function, potential, and influence from a broad perspective. The researcher observed that students develop critical thinking skills by creating new systems, situations, and solutions to real-world problems in a structured curriculum.

Technology will be vital in all fields and societies. Students learn 21st-century skills through the internet, programming, AI, IoT, robotics, mechatronics, mobile devices, and computers. These skills will help them compete globally for their desired jobs. Information technology, education, the economy, agriculture, history, arts and culture, health and medicine, research, the food and pharmaceutical industries, and others require industry-specific computer capabilities. The Sison and Devraj (2022) inquiry confirmed this.

Advanced technology enables people to practice technical abilities. Most significantly, it teaches lifelong learning. Technology should make learners love learning. It must increase curiosity. Paderna and Monterola (2022) say it must provide endless learning chances to prepare students for the future.

These reasons led the researcher to conduct a study. The Researcher wants to maximize school stakeholders' readiness. The Researcher also wanted to create adaptive K–12 STEM ICT curriculum offerings that got students technical skills, competitiveness, and readiness for the fast-changing industry.

Statement of the Problem

This study used learners' knowledge and skills evaluation and ICT-GWA to assess the school's effectiveness. The study also assessed respondents' ICT curriculum difficulties in K–12 STEM as the basis 15 for the development of ICT curricular offerings in K–12 STEM that were included in the proposed inputs for the ICT program plan. This study addressed the following research questions:

1. What are the competencies least mastered by the learners based on the Most Essential Learning Competencies (MELCs) in:

1.1 Empowerment Technology (EMPTECH)

1.1.1 knowledge

1.1.2 skills

1.2 Media Information Literacy (MIL)

1.2.1 knowledge

1.2.2 skills

2. What is the performance of the students in EMPTECH and MIL based on their general weighted average (GWA) in ICT?

3. Is there a relationship between the students' performance on ICT knowledge and skills evaluation and their GWA in relation to the schools' level of effectiveness?

4. What issues and challenges are experienced by the respondents in ICT curricular offerings in the K–12 STEM?

5. What program plan for ICT can be developed based on the results of the study?

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Hypothesis

The formulated hypothesis was tested for the fulfillment of this study;

- There is no significant relationship between the student's performance on the ICT knowledge and skills evaluation and their GWA and the school's level of effectiveness.

Scope and Delimitations of the Study

The scope of this study was concentrated on the ICT curriculum program offerings in K–12 STEM that were made available by the Department of Education. This study investigated the current state of the ICT program offerings, the types of programs that were available, and the effect that the programs have on the learning outcomes of the students in the selected schools in the National Capital Region.

The schools were chosen for relevancy, diversity, and representation. The schools were Parañaque National High School-Main, Batasan Hills National High School, Pasig City Science High School, and Manila Science High School. Many factors affecting K–12 STEM ICT curriculum design and implementation were evaluated. Here are the justifications for selection criteria:

School size affects ICT program viability and scalability. Small, medium, and large schools confronted ICT course adoption challenges and opportunities differently.

Optimizing STEM schools' technology. This criterion showed how ICT improves STEM education across disciplines.

ICT teacher professional development affects school ICT curriculum quality because ICT integration requires professional growth.

ICT curriculum analysis of school technological infrastructure, including the Internet, software, and hardware, affects ICT education.

These criteria were used to choose schools for the study to understand the K–12 STEM ICT curriculum and context. Generalizing the study's findings helps schools improve ICT instruction.

The study also identified the least-mastered ICT contents and competencies based on the K–12 program's Most Essential Learning Competencies (MELCs).

The relationship between students' performance on ICT knowledge and skills evaluation and their GWA in relation to the schools' level of effectiveness was also of interest to the researcher.

The study was also interested in identifying the most prevalent issues with the current ICT curriculum program offerings in K–12 STEM as identified by education curriculum specialists, school administrators, teachers, and students, and used the findings as a basis for creating a detailed research-based list of solution inputs and incorporating them into the recently developed program plan in ICT by the Department of Education.

The participants in this study are restricted to education curriculum specialists, school administrators, teachers, and students of the Department of Education's National Capital Region. The study's time frame is also limited to the Academic Year 2022–2023.

This research did not look at any programs that were run in other countries besides the Philippines. Aside from that, it won't include any programs that aren't connected to the ICT curricular offerings in K–12 STEM. In addition to that, this research did not incorporate other disciplines in STEM aside from ICT, which was its technical and technological aspect.

Significance of the Study

The importance of this study lies in its ability to review and assess the current ICT curriculum program offerings in K–12 STEM, address the most prevalent problems found, and develop an enhanced contextualized ICT program plan for the Department of Education, National Capital Region, which will foster the ideal environment for the role of the learner to thrive and develop to its full potential.

The ICT curriculum program offerings for K–12 STEM focused on fostering learners' advanced technical and technological skills in computer science for secondary education. These offerings frequently incorporated active learning and encouraged students to take responsibility for their learning by fostering community and collaboration among themselves.

This study could improve STEM K–12 ICT courses. By enhancing the ICT curricular offerings, the study would help students learn the latest and most relevant skills needed to succeed in the 21st century. The study suggested ways to improve ICT curricular offerings and offered recommendations on how to best put these changes into practice.

The generalizations from this study significantly advance our understanding of the chief education supervisor, educational program supervisors, school administrators, teachers, and students in the STEM strand schools.

The following individuals found the key findings of this study to be extremely significant and advantageous:

Chief Education Officer (SDO-CID). They oversee basic education curriculum data collection and design the framework and system for monitoring implementation. This study helped evaluate and improve ICT curriculum programs.

Education Program Supervisor (EPS). They helped schools and learning centers with governance, operations, and teacher preparation. They write SDO-specific career and training manuals. This study helped administrators and teachers learn advanced technical technology and ICT training.

Educational Administrators. They lead all school academic projects and activities. They're crucial to the government's goal of high-quality basic education. They include using technology to help learners learn and adapting the curriculum to maximize their potential. The study helped optimize technological infrastructure resources to meet school learning goals.

STEM Teachers. They received advanced degrees in STEM and non-STEM fields. This research helped improve teaching and curricula. The study provided teachers with new technologies and tools for better teaching and research. This study allowed teachers to collaborate on new ideas with researchers and institutions. Finally, the findings helped faculty understand STEM integration.

ICT Teachers. They earned advanced degrees in computer education and information technology. The study guided the creation of more organized, contextualized, and learner-centered learning resources.

Students. The updated ICT curricular program offerings in K–12 STEM will have the greatest impact on students. Students benefited from the study by gaining the advanced ICT technical skills essential to succeed academically and become lifelong learners.

Future Researchers. This study provided a paradigm for future K–12 STEM ICT curricular program developers. By examining K–12 STEM ICT curriculum program offerings, future researchers can find areas for improvement and develop new methods for improving ICT curriculum program offerings. This study illuminated K–12 STEM ICT curricular issues and opportunities.

REVIEW OF RELATED LITERATURE

This section presents related literature and studies that were carefully reviewed by the researcher to further explain the study.

Least Mastered Competencies in the K-12 STEM ICT

Bawal and Cuenca (2023) tested interactive learning to improve Grade 11 TVL Empowerment Technologies knowledge and skills performance. A mobile education app increased students' written and hands-on Empowerment Technologies performance, the study revealed. A descriptive study explores mobile learning app perceptions. The researchers studied whether students' perceptions of mobile learning components in their mobile-based education software predicted academic success. Most respondents were women. Parents are high school graduates earning under 10,000 pesos every month. The majority of poll respondents have smartphones at home. We also thought the mobile education software should focus on device, student, and social issues. Most respondents had fair pre-test writing skills, but mobile education improved them. Many of the attendees were practical specialists. Their performance is unrelated to mobile education app reviews. Teachers in different grades should use innovative mobile-based teaching tools.

Gecobe et. al. (2022) suggest that blenders improved their comprehension. Their exam scores which are higher than modular distance learners showed that blended and modular distance learning, pretest and posttest mean percent scores were "approaching mastery." Partial learning competencies require assistance.

In addition, modular and hybrid learners have different gain percent scores. Empowerment Technologies students pick blended learning. The experimental group outperformed the control with blended learning. This implies that blended learning helps Empowerment Technologies students.

Furthermore, the covariance analysis showed no mastery or modality effect on student achievement. Results show instructor mode does not affect math mastery.

The study concluded that blended learning students wanted better technology, user-friendly presentations, and clear guidance. Experts recommended that visual learners employ localized and contextualized assignments, incorporate more references, and use color to enhance learning for modular distant learners. Comparing Empowerment Technologies' mixed and modular remote learning modalities reveals instructional design flaws and improvements.

Borromeo et al. (2023) concluded that the COVID-19 program forced students and instructors to take online classes. During the pandemic, students and professors took online lessons from 2020–2121 to 2021–2022. Many schools embraced instructional technology to make up for the government's prohibition on in-person classes. Students used educational technology frequently during the pandemic. This study examines how educational technology tools affect digital information literacy in Philippine Dominican schools. The study methodologies were quantitative. This study polled students at two Dominican colleges in the Philippines. It measured digital and information literacy knowledge and skills, identified strengths and weaknesses, and offered therapies to improve them. Digital and information literacy were strong in both Dominican schools, according to the report. Both institutions respect privacy, are polite, and use technology. Reactivity, independence, and content knowledge are weaknesses. Suggestions were made for interventions to address student deficiencies.

In relation, based on the study conducted by Santos (2020), multidisciplinary experts and lawmakers support project-based education, ICT integration, life and work skill development, and mind and spirit nurture. Knowledge transmission trumped interpersonal and intrapersonal skills in Philippine senior high school MIL studies. Researchers examined how teaching MIL using a modified and project-based 21CC paradigm changed the cognitive, interpersonal, and intrapersonal potentials of the respondents. This study examined output-based curriculum and class performance. The study gave 138 Grade 11 students from five sections a 42-item Likert Scale online self-assessment questionnaire from May 19 to 22, 2019. The questionnaire covers evaluation, group presentations, publication, visual design, audio production, interviews, media fasting, and ethics. Inferential statistics are based on numbers. The study revealed enhanced metacognition and cognition. The modified MIL program improves cognitive, interpersonal, and intrapersonal skills ($r(100) = .307$, $p < .002$).

On the other hand, the study conducted by Dumayag (2023) investigates K–12 and non-K–12 graduates' information and media literacy in private and state higher education institutions in Cagayan, Northern

Philippines. The study examines student social media use and function using mixed methodologies. Data show students rarely use social media and fail the Curriculum Guide's Media and Information Literacy requirement.

In addition, sex, basic education preparation, SHS track, and department affiliation affected information and media literacy, but not religion, ethnicity, or academic strands. Girls have higher mean percentages than boys. Parents' income affects media literacy and information age, according to the study. Youth are more media-literate, and departmental learners vary.

According to studies, DICT, CHED, and DepEd should collaborate to improve SHS and college students' media and information literacy. To improve SHS and college students' media and information literacy, DICT, CHED, and DepEd should collaborate and expand free WiFi school zones worldwide. Additionally, regional follow-up studies on elementary, secondary, and postsecondary students' information and media literacy should be conducted.

- Competency-Based Learning Assessment

Based on the study by Mamolo, he defined competency-based learning in his study as "mastering material before moving on. Students move on to the next subject at different rates and times." Competency-based education (also called mastery-based, performance-based, and proficiency-based) has received attention and effort.

Competency-based education begins with prior knowledge assessment. Skills and knowledge help students progress. CBE helps students succeed with tailored learning support, according to Mamolo (2019).

In addition, new STEM college students receive harder competency-based courses. Student-centered, outcomes-based CBE improves learning as stated in the study conducted by Malhotra et. al. (2023).

Moreover, the software engineering skills were used to compare competency-based learning to traditional engineering education. Competency-based engineering education research informed this comparison. This detailed evaluation emphasizes competency-based software engineer training. There are five main reasons schools prefer CBE: First, CBE promotes lifelong learning. CBE encourages self-directed, inclusive learning. It concludes with timely, targeted training and assistance. Benefit #4: student-centered learning. Finally, CBE sets student expectations and promotes openness.

On the other hand, Al Shamsi in (2023) claimed that competency-based evaluation is tough and continuous, developing students. Students gain updated skills. Teachers must impart modern abilities. Education evaluations based on competency promote learning. These methods assist teachers in teaching practical skills. He said competency-based learning and evaluation require numerous instructor steps. Check student knowledge first. Ability shapes learning. Second, teachers must create learning outcomes-based lessons. Teacher-selected tests follow. Automatic grades improve low-level cognition. Graded essays, case study analysis, and observation may require higher-level thinking.

Al-Shamsi suggests instructors report learning cycle results. Competency-based performance-development monitoring follows. Case studies, interviews, questionnaires, and evaluation centers Following these steps should simplify assessment input. The strategy uses instructor input. Check student growth after competency-based learning. Outcome analysis concludes analytics training.

According to Al Shamsi (2023), competency-based evaluation promotes feedback and implementation with qualitative and quantitative measures.

- Most Essential Learning Competencies

The Department of Education says children require important learning skills in the teaching-learning process for future grades and lifelong study. Learning styles may boost education, but not skills.

Students in K–12 must meet the most Essential Learning Competencies. Academic and career success requires these talents. Reading, math, communication, problem-solving, and technology matter more in K–12.

ACTRC and the Bureau of Curriculum Development—Curriculum Standards Development Division chose important learning abilities for curriculum reform in mid-2019. Academics, bureau specialists, and field implementers defined these skills.

Secretary Leonor Magtolis-Briones updated the K–12 curriculum to satisfy RA 105333 and provide quality, relevant, and liberating education. After four curriculum review phases, the Secretary must assemble the Curriculum Consultative Committee to report under Republic Act Section 6.

DepEd's "Sulong Edukalidad" framework offers high-quality basic education to combat COVID-19 in the Philippines (Pascua, 2020). To improve education, DepEd will strengthen MELCs in SY 2020–2021, especially during emergencies.

DepEd uses 2022-2023 MELCS. DepEd Order 8, s. 2015, governs classroom assessment. MELCs will help schools, SDOs, and ROs adjust to COVID-19 and provide customized learning techniques for diverse kids.

MELCs cover all learning areas; therefore, ROs, SDOs, and schools don't need new lists. Improve and contextualize school, SDO, and RO core learning competencies.

Despite learning delivery challenges, MELCs will help DepEd showcase student talent. Simplifies online teaching tools. MELCs do not reduce K–12 curriculum guide standards. They help teachers meet curriculum and student needs.

The DepEd LCP mandates quarterly schedules and learning areas. In basic education, schools must list year-long subjects. DepEd Order No. 012, s. (2020) requires quarterly learning objectives.

Knowledge, skills, attitudes, and values comprise basic education. We verify DepEd-compliant written work, performance assignments, and quarterly evaluations. DepEd Order 8 (2015) mandates curriculum implementation in classroom assessment. Teachers assess students with it. The policy guidelines' teaching strategy changes reflect this.

The Kindergarten–Senior High School Basic Education Curriculum values variety. Many activities help students study MELCs at their own speed. This is available to all students. The study concluded that public school educators are under pressure to help kids learn vital skills and overcome educational gaps like flawed educational resources stated by Rosal et al. (2022).

School's Level of Effectiveness

- Learners Performance in Knowledge and Skills Evaluation Versus School's Level of Effectiveness

According to a study by Agyei DD (2021) student abilities and education affect school performance. Understanding the essentials boosts school and student achievement. Foundational education impacts classes.

Schools without basic abilities suffer academically. These affect school and student achievement. Guaranteeing graduates' success is key. Literacy, numeracy, communication, problem-solving, and technology aid academic and professional success. "These skills boost success," says Agyei DD (2021).

In relation, competency-effective schools assess ICT performance using the least-mastered competencies. Essential ICT students attend top ICT schools. Information, technology, communication, and teamwork matter. Low-ICT schools lack crucial abilities, according to Odell et al. (2020).

In addition, one can judge the school's efficacy and least-mastered ICT competencies differently. Students' performance shows the school's effectiveness and ICT weaknesses. Student performance may indicate school ICT skills. Divisional evaluations, quarterly summative school assessments, and local and international computer and information literacy degrees evaluate ICT skills. The study surveyed teachers and students. Student and teacher questionnaires show the school's ICT skills. The paper advises addressing competency-based learning class concerns (Hanif, 2020).

Based on the study, curriculum, teacher training, student resources, and culture affect school achievement. Successful schools respect learning, provide a safe and supportive atmosphere, and succeed academically, according to Creemers et. al. (2022).

They suggested tracking graduation rates, standardized testing, teacher quality, and school atmosphere. These indicators help administrators, parents, and others evaluate and improve school curriculum.

In addition, student performance influences academic advancement, they said. Academic achievement improves for students, parents, and teachers. Standardized tests, classroom assessments, and teacher observations evaluate students. Teacher ratings include student performance, classroom observations, and parent/student comments. This data evaluates teachers and directs classroom decisions. Teacher evaluation ensures a quality education.

Moreover, research differs on parental and community involvement. Measurements included open homes, PTAs, and school boards. Another method is parental and community volunteering. Surveys assess school, parent, and community involvement.

Based on the results of the study, parents, instructors, and students rate the school atmosphere. Researchers assessed learning environment security, efficacy, advantages, and downsides. Researchers study school climate utilizing focus groups, surveys, and interviews. Evaluations help schools, careers, and policy.

According to Cichosz (2022), youngsters learn through inspiration, interest, and effort. Inspired students finish. Technology, tutoring, and study groups boost grades. Technology, study groups, and tutoring boost grades. Passionate students save time.

According to the study, numerous factors affect school success. Grading enhances education. Projects, tests, and other activities determine grades. Multi-subject, standardized assessments assess academic performance. Students take topic and skill tests. Participation in class reflects academic performance. Cichosz (2022) says classroom activities assess academic performance.

In relation, teachers and administrators struggle with monitoring and assessing. This may affect primary school testing and learning. "Assessment, Evaluation, and Monitoring of Teaching and Learning in Nigerian Primary Schools: Difficulties and Consequences for Educators," MP Osiesi.

In addition, the study claimed that it impacts educators. Hard tests must be understood by elementary school teachers. Regular educator assessment, monitoring, and evaluation training allow this (Osiesi, 2023).

Furthermore, the study claimed that many schools struggle with testing. The study found inconsistent assessment methods across schools, poor record-keeping, the absence of standardized scales for monitoring and evaluating assessments, teachers' limited assessment experience, a shortage of assessment tools, teachers' negative attitudes toward assessment, and insufficient processing skills and expertise.

Ogunode et al. (2020) claimed that this gives teachers the abilities, knowledge, and experience to evaluate pupils in class. Teachers must assess and apply Administrators must regularly evaluate teachers using appropriate approaches. Assessments should boost classroom learning and more. Teaching requires regular, good student testing. Regular, good student testing improves thinking, abilities, and evaluation.

In addition, with the exam results, the teacher advised enhancing learning materials and facilities immediately. When good students failed prerequisites, a blind gap was created. Bad English. Information transfer, concept reception, and other factors affect student success. Additionally, formative methods impact student performance. Standards, curriculum, methods, materials, and assessments boost student success. After thorough assessment, Ramos and Ulep's (2023) K–12 English curriculum needs more ambition.

- Learners Performance in General Weighted Average (GWA) Versus School’s Level of Effectiveness

The study examined the use of the University of the Northern Philippines STEM curriculum. This study examined 12th-grade STEM students' academic achievement. The study evaluated the implementation of the

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STEM curriculum. This descriptive-correlational study assessed STEM curriculum implementation, student characteristics, and academic performance. There were 189 students, and five faculty mentors completed surveys. The university ethics committee approved the study. We used frequency, percentage, weighted mean, and correlation. The weighted average was 85–89 for many public high school girls. STEM courses are popular. There is a connection between student gender, GWA, and academic success. Academic achievement was unrelated to junior high school attendance. STEM curriculum adoption scarcely influences student performance. Science and math grades should determine academic success. Math and science teachers need curriculum development and implementation training, as concluded by Almazan et al. (2020).

In relation, the quasi-experimental study examined whether blended learning benefited first-year students' performance in JBLFMU-Arevalo's Bachelor of Science in Marine Transportation (BSMT) ICT course in the second semester of 2018–2019. The researcher surveyed similar ICT sections. There were 40 students—20 experimental and 20 control. The study used a valid and reliable 45-item multiple-choice test with a Cronbach index of 0.88. Mean, SD, Mann-Whitney, Wilcoxon-Signed. Level 5 importance We examined blended learning's impact on students' ICT skills using effect size. The experimental group had a higher pretest mean score than the control group, but the Mann-Whitney test showed comparable mean scores because the significant value was >.05. At therapy start, the experimental and control groups had very different pretest and posttest ICT performances. Successful experimental blended learning exceeded 100%. Lectures may have helped the control group samples; these were based on the findings of the study conducted by Germo (2022).

In addition, classroom ICT use has expanded in the last 20 years. This study examines how ICT influences school efficiency and production using PISA 2018 data from 5400 schools. A network DEA model evaluates the school's ICT-mediated instructional time and output efficiency. Conditional DEAs address external school efficiency challenges. Average school ICT efficiency is low and largely driven by the ability to transfer ICT-mediated instructional time into learning rather than ICT and human resources. International evidence matches. The paper recommends integrating digital technology into teaching by showing how it boosts school efficiency. Column ‘Overall’ displays Eq. (1)'s centralized network model efficiency. The overall school score comprises first-stage (‘Stage1’) and second-stage efficiency. Mergoni et al. (2023) score all schools' efficiency.

Issues and Challenges in ICT Curriculum in the K-12 STEM

Based on the study by Kanematsu and Barry, information technology is growing in K–12 STEM education. ICT has improved teaching and learning via online and interactive materials. Thus, educators must grasp K–12 STEM students' ICT curriculum alternatives. This literature review addresses K–12 STEM ICT programs.

"Information and Communications Technology" (ICT) values education over IT. ICT includes all information generation, storage, processing, and dissemination. People and institutions manage and use information with computers and other digital technology. It covers phones, TV, the internet, and software. Communication technology has grown with globalization. Business, education, entertainment, and communication use ICT. ICT may change life, work, and relationships as concluded by Kanematsu and Barry (2016).

In relation, ICT skills are crucial for school management. Individuals and society are increasingly using ICT skills in education and job management. Therefore, these areas need more technical skills. Due to the digital revolution, sociodemographics, access, and learning interests may affect ICT proficiency. Technological immersion transforms education and sets a new stage. For sustainability, social welfare education is necessary. The best education technology makes students accessible, personalized, effective, and progress-monitored, preparing future generations (Jurado et al. 2022).

In addition, their research also showed that all schools need ICT innovation. Teaching from home via digital means was more imaginative and relevant during the pandemic. Schools must teach tech skills to prepare kids for work. International education standards stress this. Digital literacy and teacher innovation matter. To meet those needs, future teachers must observe digital learning. Students and future teachers learn how to use modern teaching and learning technologies.

In conclusion, their study shows that ICT training boosts student and instructor performance. ICTs aid learning. Teachers require creative and interpretive skills beyond digital. Basic teacher training focuses on class. Lack of ICT training affects teachers. Teachers discovered strong evidence that discourages the use of new methods.

According to Hıdıroğlu and Karakaş (2022) define the integrative STEM program as integrating science, math, and engineering with technology instruction. Standards are lacking in STEM education technology. STEM education cannot use or define technology. This theoretical study examines technology's limited transdisciplinary role and science and technology integration in STEM education during the past 30 years to provide a new perspective.

Moreover, STEM training in the early stages had limitations. Technology's role in STEM education is unclear. The Innovative Teaching and Learning Research Project in seven countries found that teachers use ICT to teach, not collaborate and learn. Technology's role in STEM-supported instruction perplexed instructors the most. An important question in the field of STEM-supported instruction is how educational technology can improve STEM education, help students develop 21st-century skills, encourage critical thinking and creativity, get students involved and working together, make STEM teaching and learning more effective and appropriate, make it easier for students to get, meet individual needs, and teach a lot of STEM students. In their 2022 analysis, Hıdıroğlu and Karakaş obtained this outcome.

Based on the study, skilled preservice teachers learn K–12 basic computer science from teacher education professors. How teacher education faculty can incorporate CSed into preservice teacher preparation is unclear. Faculty debunked CS education and tech use myths. Karlin et. al (2023) found preservice instructors used CSed for equity.

South Korea, Singapore, Taiwan, Hong Kong, and China may have studied CS before Turkey. Update themes. South Korea introduced coding to CS education in 2011 to encourage problem-solving. Singaporean elementary and secondary schools teach basic ICT and CS. Secondary and advanced CS courses teach animation and game design. Hong Kong elementary and high schools teach computers, programming, and networks. Taiwan mandated CS in secondary schools in 1997. The national CS curriculum teaches computing. Japan dominates PISA and tech despite late CS education. Japanese education explains. Math and science control schools to stay up with technology, say Fiş Erümit and Keleş (2023).

In addition, education in STEM needs IT. This is crucial in the digital age. ICT covers computers, video, and web-making. STEM education grows. New ICT provides the internet, audio-visual classrooms, social networking, and more to teachers and students. This was reiterated in the study conducted by Kanematsu and Barry (2016).

Furthermore, ICT was used in STEM classes to educate students about digital literacy and computer use. Computer programming, design, architecture, and principles were less important to teachers. Students mix ICT with computer science. Chaos ensues. Unfortunately, this failed to interest pupils in studying the issue, tarnishing its reputation. STEM and ICT changed drastically in 2012.

According to Wong et. al (2019), the UK's Department for Education introduced a STEM computing curriculum in 2014 to address the country's computer skills gap. Recently, secondary school computer science instruction has increased. Schools shape pupils' computer science interests. Students form opinions and study computer science concepts. Lower secondary computer science expands on earlier computer use to teach students the subject and its tools.

In relation, many industries are emphasizing computer science. Computer science learners need professional orientation to apply it to their lives and realistically evaluate future teaching. IT workers need certification, and students need training. Taking a standalone CS course in lower secondary achieves this best by teaching computer science instead of ICT, computer literacy, or "computer driving licenses," which emphasize computer use. The 2019 Brinda et. al study emphasized this.

According to the study by Ismail et. al (2021) found that principals' technological leadership improved. Tech-based teaching lets teachers use their abilities. Good teachers will study and use technology to adapt to the country's stricter education system. 21st-century learning begins. Technology can help professors complete and engage pupils in class work.

In addition, based on the results they claimed that principals should strengthen technology leadership, the report said. To promote their methods, principals must address visionary leadership, a digital-era learning culture, and systemic change. If principals reinforce these three elements, teachers' self-efficacy may suffer. Culture, location, environment, and education impact schools. Interest will increase in teacher self-efficacy growth research.

Based on the study conducted by Kundu et. al. (2020) found low teacher ICT self-efficacy. The technological, pedagogical, and integrative efficacy domains of ICT revealed this. Participants reported insufficient school ICT infrastructure. Researchers identified a relationship between instructors' ICT self-sufficiency and infrastructure perceptions. The relationship was modest and decent. Good relationships existed between all three efficacy and infrastructure components.

In relation to the study by Agasisti et. al (2023) expect Latin American OECD PISA 2018 nations' ICT availability and use to affect school efficiency in 2023. School efficiency is achievement and skills divided by human and technological resources. Tech benefits schools, but the data is scant. Efficiency was assessed in 2757 ICT-using schools in 10 Latin American countries by PISA 2018. The study uses DEA double-bootstrap. Statistics suggest ICT boosts classroom productivity. Research impacts post-COVID-19 regional education. Political economy, education, technology adoption, and efficiency were studied. Governments, schools, and individuals are investing more public and private funds in EdTech to improve classroom ICT. EdTech spending is expanding, so students' tech use may improve school efficiency.

In addition, a mixed-methods systematic study by Cheah et. al. (2023) assessed K–12 teachers' equitable technology practices' conceptualizations, methodology, and contextual supports. This investigation was by Cheah et. al. who studied in America. Teachers need professional and personal learning groups for critical thinking and reflection. Neoliberal technology can be studied.

Moreover, researchers' conceptualizations, orientations, and contextual supports help K–12 teachers adopt inclusive technology. Fair technology learning promotes neoliberal students, meets individual expectations, promotes agency and civic involvement, and provides equal learning chances. This article offers four technological viewpoints, methodologies, and environmental aids. Reflective practitioners and critical inquirers using technology for equal learning were our focus.

Lee et. al. early-year study (2023) found that the STEM learning behavior analysis system (SLBAS) was designed to evaluate STEM learners because quantifiable results (like the final test) are insufficient and STEM education's learning process must be examined through terrible final Deep learning made this project successful. Teachers evaluate classroom learning using ICAP-mapped student behavior. SLBAS seems trustworthy. For STEM learning records, Cohen's kappa coefficient recommends SLBAS over expert coding. Expert coders overstate SLBAS and agreement. Finally, statistical research links learning and efficacy. The findings mirrored those of the earlier study. This study indicated that STEM education engages students more than teacher-led classes.

Yusof et. al. (2023) say that TVET assessment determines student learning. Bad TVET evaluations include vocational skills that don't match learning. Assessments by teachers contradict the goals. Examination of the Occupational Skill Domains and Indicators in the TVET Classroom This study used two modified Delphi phases. Competencies are in TVET literature. Nineteen TVET specialists backed Phase 2. Research suggests that TVET assessment could improve generic, career flexibility, and technical abilities for IR 4.0. We agree on cognitive, psychomotor, and affective TVET concepts. Career adaptability, occupational skills, and IR4.0 knowledge were crucial. Teachers evaluate theory, method, and mastery. TVET assessment and education improve with this study. According to research, this study may affect TVET students, teachers, institutions, and the Malaysian Ministry of Education. The TVET needs study. Facilitates learning.

In addition, educational evaluations include students and professors. Teachers use student talents to differentiate education. Teacher higher-order thinking evaluation is textbook publisher-independent. Teachers decide. Some cultures and nations may apply the findings. Classroom-based TVET assessment should meet industry standards and competencies for students and businesses. Industry-standard tests globalize pupils' skills. Real-world tests aid TVET students. TVET teachers introduce this classroom test. Malaysian TVET students take this classroom test.

The article which states that many efforts to operationalize quality technology integration (TI) into instructional practices shift TI research from device frequency to qualitative problems. Technology-based learning may benefit from teaching and TI quality. Recent research demonstrates that TI quality promotes student learning (Fütterer et al., 2022).

The subject overlap makes STEM activities integrated with STEM methods, say Rennie et. al. (2018). STEM integration is cross-, multi-, or transdisciplinary, say researchers. STEM methods include solitary, connected, nested, multidisciplinary, interdisciplinary, and transdisciplinary. STEM experts classify.

Moreover, the study says STEM teachers use it. This research needs a framework to classify K–12 STEM teachers' integration of STEM techniques. Think about integrated STEM classification. Synchronous integrated STEM teaches several courses while reinforcing ideas. Teachers teach theme-related subjects at both local and global levels. Individual teachers teach theme-related subjects. Lecture tasks need many subjects and skills. Fulfill projects. Numerous STEM classes improve student achievement. Coastal high school Marine Studies teachers can build courses around a long-term STEM focus. STEM education can help students comprehend and solve societal concerns like COVID-19.

Based on the study conducted by Le et. al. (2023) found several schools- and community-based empirical studies on integrated STEM activities and student learning. Students learned STEM consistently. STEM impacted K–12. Science learning improves with STEM synchronization. In thematically integrated STEM, elementary and middle school science courses linked engineering and design most. Out-of-school STEM initiatives focused on STEM job interests, whereas scientific curricular projects increased learning and higher-order thinking. STEM cross-curricular ignored pupils.

Bardoe et al. (2023) found no STEM integration in senior high schools. Not all schools use STEM. Lack of STEM materials, certified teachers, infrastructure, professional development, standards, curriculum, technology, and time.

Moreover, research suggests policy changes, a new STEM curriculum, infrastructural improvements, STEM buildings, and current STEM instructional gadgets. Teachers need Teachers require STEM education. STEM-savvy teachers. Short STEM courses and training provide teachers with the necessary skills and knowledge.

In conclusion, policymakers and other educational stakeholders should actively involve all stakeholders to adjust the curriculum to their needs to achieve educational goals.

Based on the study academics and administrators critique curriculum execution. Teaching methods, learning resources, curriculum reform, and student and teacher preparation are difficult. Challenges impact assessment, curriculum, and instruction. Interactions occur. Too few learning materials and infrastructure hamper curriculum implementation. DepEd first. Admin and teachers may take interim measures, but the school should solve student performance difficulties. These were the findings of Ramos-Ulep (2023).

In 2023, Medawar published "Random Acts of STEM: A Systematic Review of Local K–12 School Division STEM Experiences in Virginia," a study of random STEM contacts in Virginia schools. Topics impact teachers and administrators. STEM sense-making requires schools and administrators to create easy-to-understand STEM curricula. STEM goals and methods challenge teachers. For vertical STEM program design and connection, all school division instructors should have STEM activities and programming. Program goals set teacher expectations.

Moreover, early introduction, testing, and employment should prioritize STEM diversity. The workforce may affect VA STEM education. Schools may face criticism when obligations increase and local talent decreases. Labor shortages may move spontaneous STEM to vertically linked pipelines with more diversity and fewer leaks. Applications and results must inspire stakeholders to find answers and increase policy possibilities.

Additionally, the study assessed the ICT literacy and private school self-efficacy of junior high students in Obando, Bulacan, Philippines. In the 135-student descriptive-correlation study, ICT literacy and self-efficacy were poor. Pearson discovered that ICT literacy boosts student confidence. Given their increasing usage in education, schools should improve ICT literacy and self-efficacy. According to the report, junior high students' service affairs annual improvement goals should incorporate ICT literacy and self-efficacy. According to the report, junior high students' service affairs annual improvement goals should incorporate ICT literacy and self-efficacy. Hero (2022) emphasized the importance of these factors.

ICT Program Plan with Curricular Offerings in the K-12 STEM

According to the study, teachers in developing countries like the Philippines worry about ICT integration. Instructors must use it and teach it. Due to growth, education should use technology. Goals and needs should guide education, not ICT. Philippine K–12 ICT must show student development. The researchers believe these traits will change how Filipino students learn ICT ideas and skills to maximize learning based on the study by Morales et. al. (2019).

In addition, leadership impacts ICT development program motivation, innovation, and sustainability. effects of educators. Change has widespread opposition. Planning, convincing, and achieving cross-functional collaboration, resource sharing, and goals are leadership tasks. Creating and implementing ICT curriculum standards requires technological leadership. Teacher attitudes, talents, and acceptance of ICT in the classroom may seem overwhelming, but school leaders, administrators, and the government's collaboration to build, monitor, and sustain great practices helps achieve these aims this was based on the study by Fehintola et. al. (2021).

Moreover, Filipinos value technology for its economic and national benefits; hence, K–12 schools must teach ICT. The researcher recommends understanding the need for these standards, knowing and preparing for the challenges, having the will to pursue them using whatever resources are available, and sustaining ICT integration in schools' appropriateness, effectiveness, and sustainability. Filipino teachers are essential to school improvement, despite many obstacles. In 2013, Bonifacio researched developing ICT curriculum standards for Philippine K–12 schools.

Bonifacio's (2013) research is crucial since STEM instructional tools and transdisciplinary content are lacking. Sakhnin, Israel's SWCS curriculum, includes science and technology. The researcher reevaluated the motivation, factors, and program learning achievements of middle schoolers. The researcher formed two groups of 40 students and four groups of 80 students from a total of 120 seventh-graders. The mixed-approaches study observed class, assigned accomplishment exams, administered a motivation questionnaire before and after the course, and statistically and subjectively assessed student projects.

In conclusion, students improved their conceptual understanding and self-efficacy after struggling. The flexible instructor instruction, hands-on lab work, ICT, and project-based learning inspired the students. These were concluded from the study conducted by Awad (2023).

According to the study conducted by Pecson and Romero (2023), higher education emphasizes Design Thinking (DT) problem-solving. Secondary student-teachers at the Bataan Peninsula State University-Balanga Campus College of Education used design-based thinking to create a contextualized lesson plan. The study examined student-teacher design-based thinking in comprehending (empathizing and defining), exploring (ideating and prototyping), and materializing (testing and executing) by age and specialization. The researchers contextualized a lesson and measured the profile-based student-teacher design-based thinking. In 2022–2023, a descriptive-developmental quantitative study surveyed 199 student-teachers (60 English, 71 Filipino, and 68 Social Studies majors). The researcher used a survey questionnaire they created to analyze the findings, employing descriptive (mean and standard deviation) and inferential (t-test and F-test/ANOVA) statistics. Popular concentrations included Filipino, English, social studies, and female student-teachers. Compassionate research, creative brainstorming, and learner-centered solution implementation were student-teacher strengths. Pecson and Romero (2023) found that student-teacher strengths included compassionate research, creative brainstorming, and learner-centered solution implementation.

- Legal Bases – Enhanced Basic Education K-12 Curriculum

Here are the most important bases that served as the foundation of the research on this study Republic Act 10533 and DepEd Order No. 021 series of 2019.

Based on Republic Act No. 10533, also known as the "Enhanced Basic Education Act of 2013," under Section 2, which states that:

The state shall establish, maintain, and support a complete, adequate, and integrated system of education relevant to the needs of the people, the country, and society at large.

For this purpose, the state shall create a functional basic education system that will develop productive and responsible citizens equipped with the essential competencies, skills, and values for both lifelong learning and employment. To achieve this, the state shall:

(a) Give every student an opportunity to receive quality education that is globally competitive based on a pedagogically sound curriculum that is at par with international standards;

(b) Broaden the goals of high school education for college preparation, vocational and technical career opportunities, as well as creative arts, sports, and entrepreneurial employment in a rapidly changing and increasingly globalized environment; and

(c) Make education learner-oriented and responsive to the needs, cognitive and cultural capacity, circumstances, and diversity of learners, schools, and communities through the appropriate languages of teaching and learning, including the mother tongue as a learning resource.

Section 5 under Curriculum Development states:

Dep ED shall formulate the design and details of the enhanced basic education curriculum.

The Department of Education shall adhere to the following standards and principles in developing the enhanced basic education curriculum:

- The curriculum shall be learner-centered, inclusive, and developmentally appropriate;
- The curriculum shall be relevant, responsive, and research-based;
- The curriculum shall be culture-sensitive;
- The curriculum should be contextualized and have a global perspective.
- The curriculum shall use pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative, and integrative.

Based on DepEd Order No. 021 Series of 2019, also known as "Policy Guidelines on the K–12 Basic Education Program," under Section II under Policy Objectives, which state that:

(d) Set the frameworks for the different dimensions of the K–12 curriculum that are inclusive, developmentally relevant, and appropriate.

Furthermore, Section V, specifically the Policy Statement, states:

- The curriculum shall be learner-centered, inclusive, developmentally relevant, and appropriate.

Based on DepEd, learner-centered is an approach to education that puts the needs and interests of the students at the center of the teaching and learning process.

Section XXIX, under Features of the K–12 Curriculum, states:

The curriculum articulates standards and competencies seamlessly, based on research, and without congestion. It uses the spiral progression approach to ensure mastery of knowledge and skills after each level. The curriculum integrates information and communications technology (ICT) competencies to equip learners with skills that enable them to cope with the technological demands of our time.

Following legal bases, the researcher will redesign K–12 STEM ICT curriculum program offerings. The study emphasized STEM and ICT programs with a more skill-based approach to the fundamentals of computer science. An ICT program offering in the STEM curriculum integrates into engineering design and emphasizes technology and computational thinking. Learners study algorithms, data structures, computing, programming, and even artificial intelligence robotics and mechatronics technology.

- The Synergy in STEM Education

Modern schools must educate STEM. Mathematicians, engineers, and scientists want a top nation. STEM occupations enhance growth. National economies and global rivalries need STEM graduates. This matters because workers value technology. We need early STEM instruction and school-wide research. This was based on Sison and Devraj's December 2022 UNESCO Bangkok Asia and Pacific Regional Bureau for School report says the Philippines does poorly in three global STEM examinations despite school improvements.

President Ferdinand Marcos Jr. promised STEM education improvements in July 2022. The Philippines' commitment to STEM education suffered setbacks as it fell behind numerous Asian neighbors both worldwide and regionally. Marcos likes science. Poor government funding, education, and facilities hurt this system. Philippines R&D College STEM teachers value board testing over innovation and research, according to a 2020 poll.

The Department of Science and Technology's 300 objectives contain 174 Filipino researchers per million. Singapore has 6,730 researchers per million, Malaysia 2,200.

By 2023, 4,269 NRCP scientists will work. Engineering and industry 16.96% STEM, biology 18.79% National Capital Region scientists number 1,452 (34.57%). Second, Regional IV-A (CALABARZON) has 671 active scientists (15.98%).

The 2018–2019 CHED report shows 21.10% STEM degree completion. Science had a 25.52 percent completion rate, surpassing mathematics (21.20%), computer technology (19.56%), engineering and technology (18.97%), and medical and allied professions (14.38%). STEM workers are scarce in the Philippines. Few national STEM graduates mean few scientists. The 2019 Morales et. al. study corroborated this.

Countries require STEM graduates to compete globally and meet economic needs. Workplace technologies require this. STEM education should begin early and continue throughout school. Must-know education. The 2016 book by Kanematsu and Barry inspired this.

According to the study by Rafanan et. al. (2020): Multilevel links impair STEM integration. These links affect student behavior, curriculum, teacher interactions, and school organization.

In addition, based on their study the curriculum can include these connections. People in education and research sometimes confuse the terms "integrated," "connected," "unified," "interdisciplinary," "multidisciplinary," "cross-disciplinary," and "transdisciplinary." They must explain several aspects of integrated STEM education that their investigation revealed. Teachers encouraged students to understand and enjoy integrated content, talents, and ways of thinking about relationships, especially how they support and accompany each other.

In relation, primary and secondary schools lack STEM. Basic education separates math and science. STEM classes are separate in SHS. STEM students struggle to solve challenges. Paderna and Monterola (2022) argue that challenges in STEM are often tested separately instead of being integrated. Students will grow, solve issues, and make judgments using critical and creative thinking, according to Paderna and Monterola (2022).

According to them, this study defines integrated STEM education as STEM subject linkages across the curriculum. STEM interactions involve math, tech, engineering, and science. STEM-non-STEM curriculum integration. A non-STEM college major may not align with the industrial STEM needs that schools need to address. Schools may need to address industrial STEM needs. Real-world designers, engineers, and technologists use math and science.

Based on the study, education in technology and computer architecture must emphasize math and science. Margot and Kettler (2019) say math and science solve pupils' real-world challenges. The study examined STEM ICT K–12 courses to enhance program design. Organized programs foster creativity, critical thinking, and problem-solving.

In relation, the next industrial revolution and Society 5.0 necessitate STEM education reform. STEM students get 4.0+ post-pandemic. To fulfill current and future needs, schools must reevaluate their curriculum after COVID-19. Rafanan et. al. (2021) recommend relevant, engaging, and contextual performance challenges.

In addition, the DOE's Bureau of Curriculum Development will update all STEM curricula after sustainability and scalability studies. The DOE's Bureau of Curriculum Development can implement STEM secondary school curriculum recommendations after recalibration. Paderna and Monterola (2022) recommend innovative professional development for STEM instructors.

In conclusion, computer science basics in engineering, science, and math will replace STEM integration in ICT courses. Students should learn computers, say researchers. Computer science students must learn algorithms, data structures, computing, programming, AI, robotics, mechatronics, and IT development to use modern technologies.

The literature review for this study explored the existing research on ICT education in K–12 STEM programs, focusing on similar studies that evaluated learner performance, curriculum effectiveness, and challenges faced by students. It may include discussions on the importance of ICT education, the integration of EMPTECH and MIL in K–12 STEM, and successful models of ICT curriculum implementation. The review may also delve into broader educational literature to provide a context for understanding the significance of ICT in contemporary education and workforce preparation.

Moreover, the literature touched upon pedagogical approaches and best practices in teaching ICT, technology integration in STEM education, and the impact of ICT education on students' overall academic performance. Schools may include discussions on the challenges and issues they face in implementing ICT curricula, as well as successful strategies to address these challenges.

In summary, the literature review for this study provided a comprehensive background on the state of ICT education in K–12 STEM, highlighting existing gaps, successful practices, and challenges. The literature review served as a foundation for understanding the context in which the current study is conducted and contributed to the formulation of the research questions and hypotheses.

RESEARCH METHODOLOGY

This section provides an overview of the methods and procedures that the researcher used to carry out this study. The Researcher utilized these methods and procedures to focus on the research design, the development of ICT curricular program offerings in K–12 STEM, and the identification of problems and issues encountered by the respondents. These inputs were used to develop possible program plans in ICT, determine the population frame, gather data, select the research instrument, and apply statistical treatment to the data.

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Research Design

The study developed ICT courses in K–12 STEM for the Department of Education, National Capital Region, and collected respondents' challenges to produce an ICT project plan. The study was descriptive, quantitative, correlational, and developmental.

Descriptive quantitative correlational developmental studies use quantitative data analysis to examine developmental links and trends. This study's findings from assessments and testing of variable relationships formed the basis for product development. Creating suggestive inputs for an ICT program plan was the product. The Researcher created ICT courses that emphasized educational computer science using a backward design paradigm. After performing an evaluation and analysis of the proponents' demands and prevalent challenges in K–12 STEM ICT programs, the researcher set up an ICT curricular program. The study includes the last stages of developing K–12 STEM and ICT curricular programs. These steps entail identifying intended results or outcomes, establishing appropriate assessments, planning and selecting learning experiences and contents, organizing them by context and instructions, and evaluating feedback.

Researchers found that a descriptive study was the most effective method for identifying relationships. Researchers and participants communicated in descriptive studies. This study collected data using surveys, interviews, and assessments. The study identified the least mastered ICT contents and competencies, assessed learners' knowledge and skills, and studied school effectiveness in connection to learners' GWA. Education curriculum specialists, school administrators, instructors, and students evaluated the current ICT curricular offerings using indicator sets to identify issues and shortcomings. The researcher examined survey data to evaluate ICT-curricular programs.

Population Frame and Sampling Scheme

Purposive sampling ensures the sample's relevance and representativeness in this research. Purposive sampling targeted STEM education stakeholders involved in developing curricula, administration, teaching, and learning. This intentional method deepens and enriches the study's findings, highlighting the National Capital Region's K–12 STEM ICT curricular programs' challenges and opportunities.

This study sought to identify the ICT least-mastered contents and competencies. It also examined the relationship between students' knowledge and skills evaluation and the school's GWA in relation to school efficacy. The study also evaluated respondents' ICT curriculum difficulties and developed and evaluated K–12 STEM ICT curriculum programs. These initiatives targeted curriculum specialists, administrators, educators, and students. 751 respondents participated in this study. The study selected students from two STEM-focused regular secondary schools and two science high schools with STEM programs. Students, teachers, administrators, and curriculum specialists participated in the study. Of the 751 respondents, 187 would represent each school. DepEd NCR has these public secondary and senior high schools.

Based on difficulties raised by education curriculum specialists, school administrators, instructors, and students, this study sought to improve K–12 STEM ICT curricular programs. The study assessed learners' knowledge and skills and identified ICT topics and the least-learned competencies based on the ICT Most Essential Learning Competencies. The study also examined how learners' knowledge and skills assessment 61 performance affected the school's GWA efficacy. The researchers purposefully sampled the study. The study's sample distribution into four categories is stated below.

This study focused on STEM in NCR academic-track schools. Two regular STEM high schools were Parañaque National High School-Main and Batasan Hills National High School, and two science high schools were Pasig City Science High School and Manila Science High Schools. Seven education curriculum specialists were the Chief Education Officer (SDO-CID) and Education Program Supervisors (TLE/ICT), while seven school administrators were two principals, two senior high school assistant principals, and three TLE/ICT department heads sampled from 751 respondents.

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This survey selected 51 teachers from 751 NCR school respondents, primarily from the TLE and ICT, Science, and Mathematics departments. Most respondents teach science, math, and ICT. As part of their idea to alter K–12 STEM ICT curriculum programs, the researcher chose them for better insights into the possible suggested inputs for the ICT program plan for DepEd, National Capital Region.

There were 751 responses, and 686 samples came from four NCR STEM academic track schools. To represent all classes, four DepEd school divisions provided 172 senior high school students from each school, including 399 from Grade 11 and 287 from Grade 12.

Description of the Respondents

The respondents to this research study were diverse. The respondents included education curriculum specialists, school administrators, teachers, and students. Researchers selected all participants as school stakeholders because they were part of the academic community. Researchers used their responses to draw conclusions and make inferences about a larger population or phenomenon.

A total of seven hundred fifty-one (751) volunteers participated in the study as respondents. The study included students, teachers, school administrators, and education curriculum specialists from across the DepEd National Capital Region. A total of six hundred eighty-six (686) students came from each of the four (4) different STEM strand academic track schools in the four (4) different DepEd school divisions in the NCR, with each grade level having three hundred ninety-nine (399) grade eleven (11) and two hundred eighty-seven (287) grade twelve (12) students represented and a total of one hundred seventy-two (172) students coming from each school. The students were all in grades 11 and 12. The remaining respondents included fifty-one (51) teachers of information and communications technology (ICT), science, and mathematics. A total of seven (7) school administrators composed of two (2) school principals, three (3) assistant principals/senior high school focal persons, two (2) TLE/ICT department heads, and seven (7) education curriculum specialists composed of the Chief Education Officer (SDO-CID) and Education Program Supervisors (TLE/ICT) from the DepEd NCR's Division Offices. The table that follows provides a mathematical description of the respondents utilized in this research.

Table 1: Percentage Description of Population Samples

Group	Number of Respondents	Percentage Value
Learners	**686**	***91.34 %***
Grade 11	399	**53.13**
Grade 12	287	**38.21**
Faculty STEM	**51**	***6.8 %***
ICT	17	**2.266**
Math	17	**2.266**
Science	17	**2.266**
Administrators	**7**	***0.932 %***
Principal	2	**0.266**
Asst. Principal	3	**0.40**
TLE/ICT Head	2	**0.266**

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Education Curriculum Specialists	**7**	***0.932 %***
SDO-CID	3	**0.40**
EPS-TLE	4	**0.53**
OVERALL TOTAL	**751**	***100 %***

The table provides a breakdown of the percentage distribution for different population groups in the study. The data includes the percentage of the sample allocated to STEM faculty, school administrators, education curriculum specialists, and students. The table allows for a quick and clear understanding of the proportion of each population group within the overall sample.

Research Instrument

The study used a multiple-choice type of test to determine the least mastered ICT contents and learning competencies and a survey questionnaire to evaluate the issues experienced by the respondents in the current ICT curriculum program offerings in K–12 STEM. The questions on the learners' knowledge and skills test were based on the ICT Most Essential Learning Competencies (MELCs) set by the Department of Education. The questions also used indicators to find out what issues and problems people were having the most in K–12 STEM ICT curriculum offerings and classes. Experts validated the assessments and survey questionnaires to ensure the use of standard instruments for education curriculum specialists, school administrators, faculty, and students. The researcher also subjected the questionnaires to a reliability test to ensure the dependability and consistency of the study instruments. By assessing the reliability of measurements, the researcher can enhance the study's internal validity, compare different versions of instruments, make informed decisions based on reliable data, and establish trust and credibility in the research findings.

The questionnaire served as the data collection instrument. The study adopted the Likert scale to easily rate, quantify, and understand the generated data. The study determined the responses on a scale of 1 to 4, with verbal interpretation as shown below.

Scale Values	Ranges	Verbal Interpretation
4	3.50 – 4.00	Strongly Agree
3	2.50 – 3.49	Agree
2	1.50 – 2.49	Disagree
1	1.00 – 1.49	Strongly Disagree

Likert Scale

The Researcher provided soft and hard copies of the questionnaire to all the respondents chosen to take part in this study. She chose a total of 686 students, including 399 grade eleven (11) students and 287 grade twelve students from the senior high STEM Seven (7) educational curriculum specialists composed of the Chief Education Officer (SDO-CID) and Education Program Supervisors (TLE/ICT), seven (7) school administrators composed of two (2) school principals, three (3) assistant principals or SHS focal persons, two (2) TLE/ICT subject heads, and fifty-one (51) teachers composed of ICT, science, and mathematics made up the study's samples. She distributed hard and soft copies of the questionnaire to make it more accessible to all participants. The study evaluated the existing ICT curriculum program offerings in K–12 STEM. Here are the following

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sources of data collection items: educational curriculum specialists, school administrators, teachers, and students. These items were for assessing knowledge and skills performance and testing the relationship between the schools' effectiveness in terms of the GWA. The study determined the ICT contents and least-mastered competencies, as well as the prevalent issues encountered by the respondents in the current ICT curriculum program offerings in K–12 STEM.

The Researcher administered the questionnaire via a Google Form on the day of evaluating the learners' assessment and the issues encountered with the ICT program's curriculum offerings. She administered the questionnaire in soft copy and, at the same time, provided hard copies for easier access. She was present during the administration to facilitate real-time questioning and clarification. She provided clear instructions and conducted the survey impartially to ensure data accuracy and reliability. She allowed respondents ample time to complete the survey at their own pace and encouraged them to provide honest and thoughtful answers. She carefully analyzed the survey data by using the SPSS statistical package to draw conclusions and make informed recommendations based on respondents' feedback.

Data Gathering Methods and Procedure

The first step for the Researcher was to collect data from the subject schools and identify the appropriate number of respondents for the study. Then, she asked permission from the DepEd NCR, all subject schools and city school division offices, school administrators, and parents for the learners' consent to conduct the study. Upon approval, she immediately started the initial evaluation, followed by the development of ICT curriculum program offerings, and finally, the evaluation.

Student respondents underwent assessments to evaluate their knowledge and skills. Based on the analysis, the Researcher then determined the ICT contents and identified the least-mastered competencies. Then, she tested the relationship between the learners' performance in the knowledge and skills evaluation and school effectiveness, considering GWA. Then, she administered the survey questionnaire and identified the most common issues experienced by the respondents in ICT curricular offerings in K–12 STEM. She processed and analyzed data from surveys and interviews. The purpose of conducting an evaluation was to know and define the following important things that the study should consider: the purpose of developing ICT curriculum program offerings, the newly designed ICT curriculum program goals or the things that it wanted to accomplish, the target-specific group of people that served as the proponents of developing ICT curriculum program offerings, the ICT curriculum program contents or the kind of information the target clients expected it to have, and the most appropriate assessment for the redesigned ICT curriculum program offerings for K–12 STEM. The Researcher consolidated surveys and interviews to develop suggested inputs for possible program plans that would define ICT's overall objectives and design for the Department of Education.

During the initial evaluation of the current ICT curriculum program offerings, the Researcher collected, analyzed, and consolidated respondents' feedback to identify common issues and possible objectives for the new computer science-inclined ICT curriculum for K–12 STEM.

The Researcher ensured that all of the respondents’ suggestions were incorporated and all issues encountered were solved. The researcher analyzed the gathered data using SPSS.

Statistical Treatment of Data

This study utilized descriptive and correlational statistics, which were subdivided into measures of central tendency and measures of variability or dispersion. Measures of variability include the standard deviation or variance, the minimum and maximum variables, and the kurtosis and skewness. Measures of central tendency include the mean, the median, and the mode. Measures of variability also include the minimum and maximum variables.

Since the study dealt with data from chosen population samples, the following statistical techniques (SPSS) were employed in quantitative data analysis: The following descriptive and inferential formulas were used in the interpretation and analysis of the results:

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Cochran's Formula (Calculate Sample Size)

This was used by the researcher to determine the sample size for the study based on population sampling. The Cochran's equation was used to calculate the formula for large populations

$$\chi = \frac{Z^2\,pq}{e^2}$$

Where:

χ = is sample size

Z = is the Z score value

p = is the estimated proportion of the population

q = is 1 – p

e = is the desired level of precision

The study used Cochran's equation and a population correction for small populations of a known size to calculate the sample size. This was Cochran's equation used to calculate the formula for small populations:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where:

n = is the sample size

n_0 = is the required return sample size according to Cochran's formula

N = is the population size

Percentage

The Researcher used this to describe the respondents and, in the interpretation and analysis of the data gathered from education curriculum specialists, school administrators, educators, and students. This statistical treatment was also used in answering the problem on which it identified the list of topics and least ICT-mastered competencies from the MELCs. The percentage formula is as follows:

Percent = f/n x 100

Where:

f = frequency of set

n = total number of values

Weighted Mean

The Researcher used this to answer problems numbers one (1), two (2), three (3), and four (4), wherein the study will be able to determine the relationship between the level of effectiveness of schools and the least mastered ICT competencies and then identify the most prevalent issues encountered based on the evaluation of the current and developed ICT curriculum offerings in K–12 STEM. The formula for the weighted mean is:

$$Wx = \frac{\Sigma fx}{N}$$

Where:

Wx = weighted mean

Σfx = the sum of the response for the numerical category

N = the number of responses

Spearman's Rank-Order Correlation Coefficient (Rho)

The Researcher used Rho, Spearman's Rank-Order Correlation Coefficient, which is used to examine variable correlations in the study. Spearman's Rho, a non-parametric statistical approach, analyzes non-linear or non-normal data. This helped the study to describe the relationship between the student's performance in knowledge and skills evaluation under GWA in ICT and schools' level of effectiveness. The formula for Spearman Rho is as follows:

ρ = 1 - [(6 * Σd^2) / (n (n^2 - 1))]

Where:

ρ = (rho) is the Spearman's rank correlation coefficient.

Σd^2 = is the sum of the squared differences between the ranks of corresponding data points in the two variables.

n = is the number of data points.

Kruskall – Wallis

The Researcher used this to answer Problem Number (4), wherein the Researcher quantitatively analyzed and identified the issues experienced and the difference among the education curriculum specialist, school administrators, teachers, and students on the issues encountered in ICT curriculum offerings in K-12 STEM as perceived by the respondents. The Kruskal-Wallis test is a crucial statistical method for comparing many independent groups or treatments. For ordinal or non-normally distributed data, this non-parametric approach is a reliable way to identify strong central tendencies. In this study, the Kruskal-Wallis test helped to determine how different factors affect the dependent variable, revealing group differences and patterns that are relevant to the research goals. The formula for the Kruskal-Wallis test statistic, often denoted as H, is as follows:

H = [(12 / (N (N + 1))) * Σ (R_i^2 / n_i)] - 3(N + 1)

Where:

H = is the Kruskal-Wallis test statistic.

N = is the total number of observations across all groups.

R_i = is the sum of ranks for the i^{th} group.

n_i = is the number of observations in the i^{th} group.

Ethical Considerations of the Study

This study "Information and Communications Technology Curricular Offering in the K-12: Inputs for Program Plan" followed strong ethical standards to protect participants' rights, welfare, and privacy. Some ethical variables monitor educational research ethics throughout the process:

This study encouraged autonomy, dignity, informed consent, confidentiality, anonymity, and damage minimization. The Researcher prioritized parental agreement for minors and ensured participants understood the purpose, methodology, and potential repercussions due to K–12 school system engagement.

This study honored participants' cultural and personal views. Ethical, transparent, and social ICT course research may change educational practices and policy. The ethical protocols protected the integrity, trustworthiness, and well-being of participants and the educational community in the study.

Before the interviews, the Researcher got the informed consent. The Researcher explained the study's goals, methodologies, risks, and benefits. She informed the participants of their rights, including the right to exit from the study without penalty.

The researcher anonymizes all study data for participant privacy. Analysis conceals reports and published data. This would limit data access to approved researchers and prohibit disclosure.

Without coercion, the Researcher recruited study participants. The researcher assures participants that their involvement will not damage their grades or school relationships.

The Researcher discussed the study goals and results, clarified questions and study implications. This research maximizes benefits and minimizes harm. This study sought to reduce participant stress, discomfort, and injury.

The Researcher reported the study methods, findings, and interpretations. This study avoided selective reporting and data modification that could bias results.

Ethics monitoring was constant throughout the investigation. The researcher asked the Department of Education Regional and Division Offices for Institutional Review Board approval.

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter presents the interpretation and analysis of data gathered from the study on Information and Communications Technology (ICT) Curricular Offerings in K–12 STEM: Inputs for Program Plan. The study assessed the participants' knowledge and skills, producing a compilation of topics and identifying the ICT learning competencies from the Most Essential Learning Competencies (MELCs) that were least mastered. Through General Weighted Average (GWA), the study also looked at how effective the subject schools were in promoting the academic performance of their pupils. Evaluations of the issues and challenges that participants in the K–12 STEM ICT curriculum faced center on the competency of the faculty, the dependability of the technology infrastructure, student satisfaction with the educational process, the curriculum's fit for the STEM education environment, and the organization's readiness to make full use of ICT. The Researcher's processing, analysis, and presentation of the data gathered in chronological order focused on the problem stated in Chapter I.

The Competencies Least Mastered by the Learners Based on the Most Essential Learning Competencies (MELCs)

Table 2 displays the basis for evaluating interpretation and analysis, showing the level of mastery equivalence. This standard was used to determine the least-mastered competencies in Media and Information Literacy (MIL) and Empowerment Technology (EMPTECH) knowledge and skills assessment.

Table 2: Level of Mastery Equivalence

Percentage	Level of Mastery
96% -100%	Mastered
86% – 95%	Closely Approximating Mastery

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66% – 85%	Moving Towards Mastery
35% - 65%	Average
15% - 34%	Low
5% - 14%	Very Low
0% - 4%	Absolutely No Mastery

Source: Test Results and Item Analysis (DepEd Memorandum 480, Series 2022)

Table 3 provides a comprehensive overview of the knowledge assessment results for Information and Communications Technology (ICT) topics within the Most Essential Learning Competencies (MELCs) under Media Information Literacy (MIL). This analysis revealed nuanced patterns in student performance on specific questions, shedding light on the most challenging areas.

Table 3: Least Mastered Competencies in MIL in terms of Knowledge

Competency	Mean Percentage Score (MPS)	Level of Mastery
Identifies characteristics/describes responsible uses and competent producers of media and information.	9.00	Very Low Mastery
Evaluates the reliability and validity of audio information and media and its/their sources using selection criteria	30.00	Low Mastery
Synthesizes the overall knowledge about media and information with skills for producing a prototype of what the learners think is a future media innovation	33.00	Low Mastery
Editorializes the roles and functions of media in democratic society	37.00	Average Mastery
Evaluates the reliability and validity of manipulative information and media and its/their sources using selection criteria	45.00	Average Mastery
Over-all Mean Percentage Score	**30.80**	**Low Mastery**

Table 3 displays the mean percentage scores of students who achieved accurate responses in the knowledge assessment of the ICT topics in the Most Essential Learning Competencies (MELCs) under MIL. The results indicate that the top five questions are: "What is the potential influence of media consumption on an individual's comprehension of the world?" and "Which of the options provided is an instance of a partial or untrustworthy source of audio information and media?" Furthermore, "What potential impacts could the utilization of big data have on the media industry?"; "Which of the following is a current theory in information studies?"; and "Which of the following is a strategy for identifying manipulative information?" The average percentage score and level of mastery of the 212 students who got the question right were 8.96, which means they had very low mastery (19 of the 212 students who got it right), 29.72, which means they had low mastery (63 of the 212 students who got it right), 32.54, which means they had low mastery (69 of the 212 students who got it right), and 36.79, which means they had average mastery (78 of the 212 students who got it right). The overall Mean Percentage Score was 30.56, with a low mastery level of equivalent.

This results provides insights into the knowledge assessment of Information and Communications Technology (ICT) topics within the Most Essential Learning Competencies (MELCs) under Media and Information Literacy (MIL). The focus is on the top five questions and the performance of students in terms of percentage scores and mastery levels.

The results analysis indicates that, on average, students demonstrated a relatively low level of mastery in the assessed ICT topics under MIL. The majority of students achieved low mastery levels in the top five questions, with some reaching an average level. The overall Mean Percentage Score (MPS) of 30.56 further reinforces the low mastery level. The following were the possible implications of these results:

1. There is a need for targeted interventions to enhance students' understanding of essential ICT topics.
2. Educators should consider revisiting and reinforcing key concepts related to media and information literacy to improve student performance.
3. The results highlight areas of weakness that can inform curriculum adjustments and instructional strategies to better address the identified challenges.
4. Continuous assessment and feedback mechanisms are crucial for ongoing improvement in students' mastery of ICT topics in MIL.

This analysis underscores the importance of addressing the identified knowledge gaps and promoting a higher level of mastery among students in ICT topics related to media and information literacy.

These findings served as a foundation for refining educational strategies, emphasizing specific topics within the MELCs framework to address knowledge gaps. Targeted interventions and additional instructional support may be beneficial for enhancing student comprehension of complex topics such as the potential impacts of big data on the media industry. Ongoing assessment and iterative adjustments to teaching approaches can contribute to continuous improvement in Media Information Literacy education.

Table 4 provides a detailed insight into the skills assessment of Information and Communications Technology (ICT) topics within the Most Essential Learning Competencies (MELCs) under the subject of Media and Information Literacy (MIL). The focus of this analysis is on the prominence and challenges presented by specific questions, offering valuable perspectives on students' skills within the context of the present new media society.

Table 4: Least Mastered Competencies in MIL in terms of Skills

Competency	Mean Percentage Score (MPS)	Level of Mastery
Editorializes the roles and functions of media in democratic society	36.32	Average Mastery
Produces and evaluates a creative motion-based presentation using design principle and elements	65.09	Average Mastery
Puts into practice their understanding of the intellectual property, copy right, and fair use guidelines	68.00	Moving Towards Mastery
Synthesizes overall knowledge about different information and media sources by producing and subsequently evaluating a creative multimedia form (living museum, electronic portfolio, others)	72.16	Moving Towards Mastery

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Explains actions to promote ethical use of media and information.	73.00	Moving Towards Mastery
Over-all Mean Percentage Score	**62.91**	**Average Mastery**

Table 4 displays the mean percentage scores of students who achieved correct responses in the skills assessment of the ICT topics within the Most Essential Learning Competencies (MELCs) under the subject of Media and Information Literacy (MIL). The results indicate that the five most prominent questions pertain to the present new media society. "How can the media contribute to fostering civic engagement and involvement in a democratic society?"; "What is the purpose of using motion graphics software for the creation of motion media?"; "Which of the following is an example of intellectual property infringement?"; "What are design principles and elements, and why are they important in creating multimedia presentations?"; and "Which of the following is not a way to combat the digital divide?" had the lowest number of students who answered correctly, with a mean percentage score of 36.32, having an average mastery level (77 out of 212 students who got it right), 65.09 having an average mastery level (138 out of 212 students got it right), 67.92 having a moving towards mastery level (144 out of 212 students got it right), 72.16 having a moving towards mastery level (153 out of 212 students got it right), and 72.64 having a moving towards mastery level (154 out of 212 students got it right). Correspondingly, it got an overall mean percentage score of 62.83 with an average mastery level equivalent.

This results provides insights into the skills assessment of Information and Communications Technology (ICT) topics within the Most Essential Learning Competencies (MELCs) under the subject of Media and Information Literacy (MIL). The focus is on the top five questions, the number and percentage of students who answered correctly, and the mean percentage score with associated mastery levels.

The results analysis reveals a varied performance among students in the skills assessment of ICT topics under MIL. While questions related to the present new media society showed relatively stronger performance, questions addressing topics such as intellectual property infringement and combating the digital divide had lower correctness rates. The following were the possible implications of these results:

1. **Focus on Specific Weaknesses.** Educators should pay attention to specific areas where students demonstrated lower proficiency, such as intellectual property infringement and strategies to combat the digital divide.

2. **Curriculum Refinement.** The results suggest a need for refining the curriculum to ensure a more comprehensive understanding of essential skills in media and information literacy.

3. **Pedagogical Strategies.** Implementing varied pedagogical strategies, including real-world applications and case studies, can enhance students' practical skills in media and information literacy.

4. **Continuous Improvement.** Regular assessments and feedback loops are essential to monitor student progress continually and make necessary adjustments to improve overall mastery levels.

The analysis provides valuable insights into the strengths and weaknesses of students in the skills assessment of ICT topics in MIL. Addressing the identified areas of weakness through targeted interventions and curriculum adjustments can contribute to enhancing students' overall mastery of media and information literacy skills.

Identifying and addressing challenges in specific skill areas, such as intellectual property infringement and design principles, can inform targeted instructional strategies. Incorporating real-world examples and applications related to the challenges identified may enhance students' practical skills and understanding. Continuous assessment and adaptation of teaching methodologies can contribute to refining the skills development aspect of Media and Information Literacy education.

Based on the results and analysis of this study's knowledge and skills evaluation, Borromeo et al. (2023) found a partial relationship between Media and Information Literacy (MIL) and the study's results. Here is a brief discussion of their study. The epidemic requires online classes for students and teachers from 2020–2121 to

2021–2022. Schools used various instructional technologies to circumvent the government's in-person sessions. Pandemic students utilized digital learning. Learn how instructional technology affects Philippine-Dominican school digital literacy. The study was quantitative. The study polled Filipino students at two Dominican colleges. The purpose was to evaluate respondents' digital and information literacy knowledge and skills performance, highlight strengths and problems, and suggest changes. A survey found both Dominican schools proficient in digital and information literacy. Both schools encourage privacy, mindfulness, and technology. The schools limit reactivity, autonomy, and subject-matter knowledge. Experts suggested interventions to address student weaknesses.

Table 5 delves into the assessment of Information and Communications Technology (ICT) knowledge within the Most Essential Learning Competencies (MELCs) for Empowerment Technology (EMPTECH). This analysis provides insights into students' proficiency in key areas and highlights questions that pose challenges, shedding light on the nuanced landscape of ICT knowledge in the context of social change.

Table 5: Least Mastered Competencies in EMPTECH in terms of Knowledge

Competency	Mean Percentage Score (MPS)	Level of Mastery
Analyze how target or intended users and audiences are expected to respond to the proposed ICT Project for Social Change on the basis of content, value, and user experience.	25.93	Low Mastery
Identify a local or regional cause or issue for Social Change related to specific professional tracks that can be addressed or tackled using an ICT Project for Social Change.	31.79	Low Mastery
Share and showcase existing or previously developed material in the form of a collaboratively designed newsletter or blog site intended for a specific audience or viewer.	32.41	Low Mastery
Apply web design principles and elements using online creation tools, platforms, and applications to communicate a message for a specific purpose in specific professional tracks.	49.38	Average Mastery
Develop a working prototype of an ICT Project for Social Change.	52.47	Average Mastery
Over-all Mean Percentage Score	**38.39**	**Average Mastery**

Table 5 displays the mean percentage scores of students who achieved accurate responses in the assessment of ICT knowledge under the Most Essential Learning Competencies (MELCs) for Empowerment Technology (EMPTECH). The results indicate that the questions "Which of the following is a minor reason why analyzing the expected response of target or intended users is important for an ICT project for social change?"; "Why is it important to choose a cause or issue that is relevant to your community?"; "What is the purpose of distributing and presenting current or previously created content via a newsletter or blog site?"; "What are some online creation tools, platforms, and applications that can be used to apply web design principles and elements?"; and "Which of the following is an important consideration when developing a working prototype for an ICT project for social change?" had the lowest number of students who answered correctly. The mean percentage score of correct answers was 25.93 with a low mastery level (84 out of 324 students got it right), 31.79 with a low mastery level (103 out of 324 students got it right), 32.41 with a low mastery level (105 out of 324 students got it right),

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49.38 with an average mastery level (160 out of 324 students got it right), and 52.47 with an average mastery level (170 out of 324 students got it right), respectively, having an overall mean percentage score of 39.50 with an average mastery level equivalent.

This results delves into the assessment of ICT knowledge under the Most Essential Learning Competencies (MELCs) for Empowerment Technology (EMPTECH). Table 5 highlights specific questions with lower correct response rates, sheds light on areas where students struggled, and provides a mean percentage score with associated mastery levels.

The results analysis reveals challenges in students' understanding of certain aspects of ICT knowledge under EMPTECH. Questions related to analyzing user responses, choosing relevant causes, and considerations in developing prototypes for social change projects exhibited lower correctness rates. The following were the possible implications of these results:

1. **Targeted Instruction.** Educators may need to provide targeted instruction on analyzing user responses, selecting relevant causes, and prototype development to enhance students' comprehension in these areas.

2. **Application of Concepts.** Encouraging real-world applications and case studies may help students apply theoretical concepts in the context of ICT projects for social change.

3. **Interactive Learning.** Incorporating interactive learning methods, such as group projects or discussions, can facilitate a deeper understanding of the practical implications of EMPTECH concepts.

4. **Continuous Assessment.** Regular formative assessments and feedback mechanisms are crucial to identifying and addressing persistent challenges in students' mastery of EMPTECH.

The analysis underscores the need for targeted interventions and instructional strategies to improve students' mastery of specific ICT knowledge areas in the context of Empowerment Technology. Addressing these challenges can contribute to a more comprehensive and effective understanding of EMPTECH concepts.

Developing targeted instructional strategies can address challenges in understanding concepts related to user analysis, community relevance, and content distribution. Incorporating real-world examples and case studies relevant to social change contexts may enhance students' practical application of ICT knowledge. Continuous assessment and iterative adjustments to teaching methodologies can contribute to refining the integration of ICT for social change within the Empowerment Technology curriculum.

Table 6 presents a detailed overview of the skills assessment results for Information and Communications Technology (ICT) topics within the Most Essential Learning Competencies (MELCs) for Empowerment Technology (EMPTECH). This analysis offers insights into students' proficiency in specific skill areas and highlights questions that garnered both strong and challenging responses.

Table 6: Least Mastered Competencies in EMPTECH in terms of Skills

Competency	Mean Percentage Score (MPS)	Level of Mastery
Apply web design principles and elements using online creation tools, platforms, and applications to communicate a message for a specific purpose in specific professional tracks	56.79	Average Mastery
Identify a local or regional cause or issue for Social Change related to specific professional tracks that can be addressed or tackled using an ICT Project for Social Change	62.04	Average Mastery

Analyze how target or intended users and audiences are expected to respond to the proposed ICT Project for Social Change on the basis of content, value, and user experience	66.67	Moving Towards Mastery
Create original or derivative ICT content to effectively communicate or present data or information related to specific professional tracks.	69.44	Moving Towards Mastery
Develop a working prototype of an ICT Project for Social Change	70.06	Moving Towards Mastery
Over-all Mean Percentage Score	**65.00**	**Average Mastery**

Table 6 displays the mean percentage scores of students who achieved accurate responses in the skills assessment of the ICT topics in the Most Essential Learning Competencies (MELCs) within Empowerment Technology (EMPTECH). The top five questions, including "How can typography be used to effectively communicate a message in web design?" and "How can ICT projects for social change be expanded or replicated in other communities?", were answered correctly by the highest number of students. The questions "What is the impact of an ICT project on social change?" The lowest number of students answered the questions "How can you not effectively communicate a visual message through ICT content in an online environment?" and "How can the success of an ICT project for social change be measured?" correctly. The mean percentage scores of students who answered correctly were 56.79 with an average mastery level (184 out of 324 students got it right), 62.04 with an average mastery level (201 out of 324 students got it right), 66.67 with a moving towards mastery level (216 out of 324 students got it right), 69.44 with a moving towards mastery level (225 out of 324 students got it right), and 70.06 with a moving towards mastery level (227 out of 324 students got it right), respectively, with an overall mean percentage score of 65.00 with an average mastery level.

Table 6 shows the average percentage scores of students on tests of their ICT skills related to the Most Essential Learning Competencies (MELCs) for Empowerment Technology (EMPTECH), which can teach us a lot about how well students can use these skills in real life.

Based on the results of the study, students demonstrated moderate level of proficiency, especially in questions related to the effective use of typography in web design and the expansion or replication of ICT projects for social change. The majority of students showcased understanding of the impact of ICT projects on social change. Questions that involved practical applications, such as communication of visual messages and measurement of project success, also received relatively moderate responses. However, students found it challenging to understand how to measure the success of an ICT project for social change. This area might benefit from additional focus or clarification. The question about not effectively communicating a visual message through ICT content in an online environment also had a lower correct response rate, suggesting a potential need for more emphasis on this aspect. The following were the possible implications of these results:

1. **Targeted Instruction.** Educators may consider providing targeted instruction on measuring the success of ICT projects for social change and the effective communication of visual messages.

2. **Practical Application Emphasis.** Continuing to emphasize practical applications of ICT skills, as evident in the strong performance on questions related to web design and project expansion, can reinforce real-world relevance.

3. **Formative Feedback.** Regular formative assessments and feedback loops can help address specific areas of weakness and guide instructional adjustments.

4. **Encouraging Critical Thinking.** Encouraging students to think critically about the social impact of ICT projects and their success metrics could foster deeper comprehension.

The analysis suggests that while students exhibit moderate proficiency in various EMPTECH skills, there are specific areas, such as measuring project success, where targeted instruction and emphasis may further enhance their mastery levels. The overall average mastery level indicates a solid foundation but also highlights room for continuous improvement.

Developing targeted instructional strategies can address challenges in understanding the impact assessment and communication effectiveness of ICT projects for social change. Incorporating practical exercises and case studies relevant to these challenging topics may enhance students' application of skills in real-world contexts. Continuous assessment and iterative adjustments to teaching methodologies can contribute to refining the skills development aspect of Empowerment Technology within the MELCs framework.

Bawal and Cuenca (2023), examined interactive learning software to improve Grade 11 TVL Empowerment Technologies results in Mobile-Based Education App for Improved Performance. A mobile education app improved students' written and hands-on Empowerment Technologies performance, the study found. A descriptive study examines mobile learning app reviews. The study examined whether mobile learning component assessments in mobile-based education software predicted academic success. Most respondents were women. Parents are high school graduates earning under 10,000 pesos every month. The majority of poll respondents have smartphones at home. Mobile education software should address device, student, and social challenges. Mobile education enhanced pre-test writing averages. Many of the attendees were practical experts. Their performance is unrelated to mobile education app reviews. The proven hypothesis in this study is that Different grade teachers should use modern mobile teaching tools.

The Performance of the Students in EMPTECH and MIL Based on their General Weighted Average (GWA) in ICT

Table 7 shows the school's Media and Information Literacy (MIL) performance. The General Weighted Average (GWA) with "Passed" indicating effectiveness and "Failed" indicating ineffectiveness.

Table 7: School's Level of Effectiveness Based on Students' Performance in terms of General Weighted Average (GWA) in ICT (MIL)

GWA	**Frequency**	**Percentage**	**Remarks**
74 and below (did not meet expectation)	0	0%	Failed
75-79 (fairly satisfactory)	0	0%	Passed
80-84 (satisfactory)	1	0%	Passed
85-89 (satisfactory)	100	47%	Passed
90-100 (outstanding)	111	52%	Passed
Total	**212**		

Source: Grading System (DepEd Order 08, Series 2015)

Table 7 displays the school's level of effectiveness by assessing students' achievement in terms of their general weighted average (GWA) in MIL. In order to assess the degree of effectiveness, the researcher employed a grading system and comments, whereby "Passed" indicates effectiveness and "Failed" indicates ineffectiveness. All students have received a "Passed" remark. There is one student with a General Weighted Average (GWA) between 80-84, 100 students with a GWA between 85-89, and 111 students with a GWA between 90-100. This indicates that the school is effective in imparting ICT knowledge and skills to its students.

The GWA analysis provides a deeper picture of student achievement and implies the school has attained its pedagogical objectives in this domain. Continuous review and development will help the school prepare learners for digital challenges.

Examining the school's MIL subject teaching and learning methodologies can help identify its success factors. Understanding its success factors can improve future teaching techniques. Despite its efficacy, there may be room for improvement. Analyzing GWA distribution and student performance within specific GWA ranges can reveal areas that need more attention or focused interventions.

Continuously monitoring MIL students' achievement is essential for growth. This study found that regular assessments, feedback, and teaching method changes can maintain or improve efficacy.

Table 8 shows the school's Empowerment Technology (EMPTECH) performance. The General Weighted Average (GWA) with "Passed" indicating effectiveness and "Failed" indicating ineffectiveness.

Table 8: School’s Level of Effectiveness based on Students’ Performance in terms of General Weighted Average (GWA) in ICT (EMPTECH)

GWA	Frequency	Percentage	Remarks
74 and below (did not meet expectation)	0	0%	Failed
75-79 (fairly satisfactory)	0	0%	Passed
80-84 (satisfactory)	10	3%	Passed
85-89 (satisfactory)	99	31%	Passed
90-100 (outstanding)	215	66%	Passed
Total	**324**		

Source: Grading System (DepEd Order 08, Series 2015)

Table 8 displays the school's effectiveness level, which is determined by students' performance in terms of a general weighted average (GWA) in EMPTECH. In order to assess the level of effectiveness, the researcher employed a grading system and remarks, where "Passed" denotes effectiveness and "Failed" denotes ineffectiveness. All students have achieved a "Passed" status. Specifically, there are 10 students with a Grade Weighted Average (GWA) between 80-84, 99 students with a GWA between 85-89, and 215 students with a GWA between 90-100. This indicates that the institution successfully imparts information and skills in EMPTECH to its learners.

The breakdown of students into GWA ranges helps explain performance levels. In particular, 10 students have a GWA between 80 and 84, 99 between 85 and 89, and 215 between 90 and 100. This distribution shows excellent achievement, with most students scoring in the higher GWA ranges.

The fact that no students "Failed" indicates that the school had imparted EMPTECH skills and knowledge effectively. The GWA ranges, notably the 90–100 student concentration, show high performance overall. This positive outcome shows EMPTECH's teaching and learning methods' effectiveness.

The table demonstrates that pupils' positive performance across GWA categories indicates the school's effective teaching of the EMPTECH curriculum. This positive conclusion speaks well for the school and shows its success in teaching EMPTECH to students.

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The study evaluated the EMPTECH and MIL GWA of students. The distribution shows school performance. The rise in GWA stresses quality training and continual assessment and growth to prepare students for digital issues.

In addition, GWA distribution and student performance show MIL and EMPTECH's educational effectiveness. Effective teaching requires monitoring, assessing, giving feedback, and adjusting approaches. GWA analysis helps schools identify success, priorities, and growth-oriented instruction.

The Researcher evaluated the STEM programs at the University of the Northern Philippines using students' General Weighted Average (GWA) as predictors of the school's level of effectiveness. The study investigated 12th-grade STEM students' academic performance and examined STEM curriculum implementation. The study used descriptive-correlational to examine STEM curriculum implementation, student characteristics, and academic performance. Five faculty mentors surveyed 189 students. The study employed a weighted mean, frequency, percentage, and correlation. Many public high schools average 85–89, and STEM courses are popular. GWA affects student gender and academic success. Academic performance was unaffected by junior high attendance. STEM curriculum adoption barely affects student achievement, according to Almazan et al. (2020).

The Relationship Between the Students' Performance in ICT Knowledge and Skills Evaluation and their GWA in Relation to the Schools' Level of Effectiveness

Table 9 presents that all variables are not Normal, with a Sig value less than 0.05. Therefore, the Researcher used non-parametric tests.

Table 9: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Least mastered ICT competencies Score (MIL)	.175	212	.000	.938	212	.000
Least mastered ICT competencies Score (EMPTECH)	.148	212	.000	.859	212	.000
General weighted average (GWA) in MIL	.256	212	.000	.851	212	.000
General weighted average (GWA) in EMPTECH	.210	212	.000	.831	212	.000

a. Lilliefors Significance Correction

The Kolmogorov-Smirnov and Shapiro-Wilk tests show that MIL and EMPTECH's least mastered ICT competencies score and GWA are not normal. Large p-values (< 0.05) reject the normal distribution null hypothesis for each variable.

Because normalcy is violated, the Researcher chose non-parametric tests. Nonparametric tests can test non-normal data without normality assumptions. Most normalcy tests are Kolmogorov-Smirnov and Shapiro-Wilk. These tests' statistical results and p-values disprove the normally distributed data null hypothesis. All p-values below 0.05 suggest that the data deviates considerably from a normal distribution.

Since it was non-normal data, the Researcher used the Rho Spearman Correlation Coefficient statistical treatment to compare groups using non-parametric tests. The Researcher utilized non-parametric tests since the data shows non-normal distributions. This method offered strong statistical analysis without breaking normalcy.

Table 10 presents Spearman's rho which shows that the General Weighted Average correlates with MIL knowledge and skills. The 0.000 p-value, below 0.05, suggests the correlation is not random.

Table 10: The Relationship Between the Knowledge and Skills Evaluation under MIL for GWA

Correlations				
			General Weighted Average (GWA) in MIL	Least Mastered ICT Competencies Score (MIL)
Spearman's rho	General weighted average (GWA) in MIL	Correlation Coefficient	1.000	.317**
		Sig. (2-tailed)		.000
		N	212	212
	Least mastered ICT competencies Score (MIL)	Correlation Coefficient	.317**	1.000
		Sig. (2-tailed)	.000	
		N	212	212

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

A Spearman's rho Correlation Test was performed to determine the relationship between the evaluation of Knowledge and Skills in Media and Information Literacy (MIL) and the GWA (General Weighted Average). The analysis showed that there is a statistically significant association between the evaluation of Knowledge and Skills in MIL and GWA. This is because the computed alpha value of 0.000 is lower than the crucial value of 0.05. The correlation analysis indicates a positive association between the scores, with a correlation coefficient of 0.317. While the average evaluation results for Knowledge and Skills in MIL may be improving, the General Weighted Average (GWA) can also be increasing.

A positive correlation coefficient of 0.317 indicates a good score association. Above the General Weighted Average, MIL skills improve. The correlation coefficient indicates a moderate link between variables.

Media and Information Literacy appear to affect GWA academic performance. MIL students may perform well in other subjects, raising their GWA. Positive associations show MIL scores boost GWA. This shows media and information literacy may improve academic performance.

Media and information literacy positively affect students' GWA. This may affect media and information literacy education for academic success.

Table 11 presents the GWA and EMPTECH's Knowledge and Skills evaluations, which are highly correlated. The association was not random because the 0.000 p-value is below 0.05.

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Table 11: Relationship Between the Knowledge and Skills Evaluation under EMPTECH for GWA

Correlations				
			General weighted average (GWA) in EMPTECH	Least mastered ICT competencies Score (EMPTECH)
Spearman's rho	General weighted average (GWA) in EMPTECH	Correlation Coefficient	1.000	.271**
		Sig. (2-tailed)		.000
		N	324	324
	Least mastered ICT competencies Score (EMPTECH)	Correlation Coefficient	.271**	1.000
		Sig. (2-tailed)	.000	
		N	324	324

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

A Spearman's rho Correlation Test was performed to determine the relationship between the evaluation of Knowledge and Skills under EMPTECH and the GWA. The analysis showed that there is a statistically significant association between the evaluation of Knowledge and Skills in MIL and GWA. This is because the calculated alpha value of 0.000 is lower than the crucial value of 0.05. The correlation analysis indicates a positive association between the scores, with a coefficient of 0.271. While the average evaluation scores for Knowledge and Skills in Media and Information Literacy (MIL) may be improving, the Grade Weighted Average (GWA) can also be increasing.

A positive correlation of 0.271 implies a score relationship. Because EMPTECH evaluates Knowledge and Skills better, GWA grows. Despite the moderate coefficient magnitude, the correlation suggests a strong relationship.

Successful EMPTECH Knowledge and Skills students had higher GWAs. EMPTECH skills affect academic success, so they may change instructional tactics.

As with past research, correlation does not indicate causality. Further research is necessary to establish the reasons behind the positive correlation between EMPTECH scores and GWA.

EMPTECH's Knowledge and Skills evaluation positively correlates with students' GWA. Teachers and institutions can understand EMPTECH evaluations' academic effects with this information.

To sum it all, the study conducted a Spearman's Rho Correlation Test to explore the relationship between the evaluation of Knowledge and Skills in Media and Information Literacy (MIL) and the General Weighted Average (GWA). The results indicate a statistically significant association between MIL scores and GWA, with a computed alpha value of 0.000, lower than the critical value of 0.05. The positive correlation coefficient of 0.317 suggests a moderate link between the two variables.

The findings imply that as scores in Knowledge and Skills in MIL improve, GWA also tends to increase. This positive association is noteworthy, indicating that students excelling in MIL may likely perform well academically overall. The positive correlation coefficient of 0.317 signifies a good score association and suggests a moderate link between MIL scores and GWA.

Furthermore, a similar analysis was performed for the evaluation of Knowledge and Skills under EMPTECH, revealing a statistically significant association with GWA. The positive correlation coefficient of 0.271 suggests that as EMPTECH scores improve, GWA also tends to increase. Despite the moderate coefficient magnitude, the correlation implies a strong relationship, indicating that successful EMPTECH Knowledge and Skills students tend to have higher GWAs.

The study underscores the potential impact of MIL and EMPTECH skills on overall academic performance. It suggests that MIL and EMPTECH evaluations might serve as indicators of academic success, with positive associations indicating that proficiency in these areas could positively influence GWA. However, it is important to note that correlation does not imply causation, and further research is necessary to investigate the underlying reasons for these observed associations.

In conclusion, the study suggests that MIL, as well as EMPTECH skills, positively correlate with students' General Weighted Average. This information can be valuable for educators and institutions in understanding the academic effects of these evaluations and potentially refining instructional tactics.

In relation to the results of the study, competency-effective schools assess ICT performance using least-mastered competencies. Top schools educate essential ICT students. Odell et. al. (2020) concluded that low-ICT schools lack essential skills in information and communications technology, where teamwork is crucial.

However, the study conducted by Hanif (2020) presents a different perspective on how the school's effectiveness and least-mastered ICT skills are viewed. Student performance reflects school and ICT strengths and weaknesses. Student performance may indicate school ICT skills. Divisional evaluations, quarterly summative school exams, and local and international computer and information literacy degrees assess ICT skills. The study polled teachers and pupils. Student and teacher surveys demonstrate the school's ICT skills. The report suggests correcting competency-based learning classes.

Table 12 presents the summary of the two Spearman's rho Correlation Tests that explored the correlations between MIL and EMPTECH, the General Weighted Average (GWA), and MIL and EMPTECH Knowledge and Skills Evaluation to the school's level of effectiveness.

Table 12: Summary of Correlation Statistical Test

			General weighted average (GWA) in MIL	Least mastered ICT competencies Score (MIL)	General weighted average (GWA) in EMPTECH	Least mastered ICT competencies Score (EMPTECH)
Spearman's rho	General weighted average (GWA) in MIL	Correlation Coefficient	1.000	.317**	.064	.135*
		Sig. (2-tailed)		.000	.355	.050
		N	212	212	212	212
	Least mastered ICT competencies Score (MIL)	Correlation Coefficient	.317**	1.000	.061	.129
		Sig. (2-tailed)	.000		.380	.061
		N	212	212	212	212

	General weighted average (GWA) in EMPTECH	Correlation Coefficient	.064	.061	1.000	.271**
		Sig. (2-tailed)	.355	.380		.000
		N	212	212	324	324
	Least mastered ICT competencies Score (EMPTECH)	Correlation Coefficient	.135*	.129	.271**	1.000
		Sig. (2-tailed)	.050	.061	.000	
		N	212	212	324	324

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

GWA is statistically linked to MIL Knowledge and Skills evaluation. Since 0.000 is less than 0.05, the correlation is unlikely to be random. GWA grows with MIL scores, according to the moderately positive correlation coefficient of 0.317. Students who thrive at MIL may do well academically.

GWA is statistically linked to Knowledge and Skills evaluation for EMPTECH. 0.000 alpha is below 0.05. GWA rises with EMPTECH results, according to the moderately positive correlation coefficient of 0.271. Students who excel in EMPTECH may do better academically.

Better MIL or EMPTECH Knowledge and Skills ratings improve General Weighted Averages in both studies. It appears that students' academic performance improves when they master these subjects.

MIL and EMPTECH abilities may increase students' academic performance, according to these data. Therefore, further research is necessary to understand the reasons behind these correlations, as correlation does not imply causality.

Table 13 provides a summary of issues and challenges experienced by the student respondents based on the evaluation of ICT curricular offerings in K–12 STEM. Respondents' evaluations are based on positive statements, and the researcher identified the issues and challenges with the lowest mean score.

The Issues and Challenges Experienced by the Respondents in ICT Curriculum Offerings in the K-12 STEM

Table 13: Issues and Challenges Experienced by the Student Respondents in the ICT Curricular Offerings in K-12 STEM

Issues and Challenges	Mean	Verbal Interpretation
2.1.1 limited computer laboratories for the number of students enrolled in the STEM program.	3.07	Agree
2.1.2 have maker spaces and simulation classrooms for STEM-related hands-on activities (such as design planning, programming, electrical and electronics, robotics, mechatronics, etc.).	3.04	Agree
2.1.3 lack an e-classroom that may be used as a lecture hall and a collaborative space for STEM teaching.	2.82	Agree

2.3.1 ratio of hardware and digital equipment (desktop computers, laptops, tablets, smart boards, etc.) and software installed to teach ICT to STEM students in the program is insufficient.	3.05	Agree
2.3.2 software used to teach ICT in STEM is open source, always has an updated version, and is compatible with the hardware and other computer devices once installed.	3.06	Agree
2.3.3 network connectivity requirements are inadequate for an integrated discipline approach in a STEM environment, and when used for classroom instruction, it frequently experiences downtime or disruptions and is unreliable on a regular basis.	3.05	Agree
3.1.2 reduce interaction with teachers as well as peers and do not encourage learning, confidence, or self-esteem.	2.59	Agree
3.2.1 limited their exposure to different ICT skills and prevented them from learning other valuable skills.	2.62	Agree
3.2.3 constrained the curriculum's flexibility, so they were less inclined to explore other areas of ICT.	2.82	Agree
3.3.2 encourage an over-reliance on technology, which may limit student diversity.	2.89	Agree
3.4.2 is a source of distraction that limits their exposure to other important collaboration skills and negatively impacts learning outcomes.	2.58	Agree
3.5.1 makes learners overly dependent on their teachers, limiting their ability to learn, explore, and discover independently.	2.56	Agree
3.5.3 restricts students' exposure to other teaching methods and views, limiting their learning outcomes and satisfaction.	2.54	Agree
5.2.2 is hindered by a lack of time, the dread of losing competitive advantage, a lack of trust in colleagues, the absence of incentives or recognition, and a lack of knowledge or expertise.	2.76	Agree
5.3.3 technical support and maintenance practices aren't up to date with the latest technology, and any upgrades or improvements are least prioritized and always delayed.	2.95	Agree
5.4.3 lacks policies, programs, and projects to encourage ICT technical development training for faculty, office staff, and the school community.	2.69	Agree

Table 13 displays the issues and challenges as perceived by the students. The Researcher includes issues with a 3.10 or below mean score because, statistically, they received relatively moderate responses and fall under priority issues. The students have identified a total of sixteen issues and challenges in the ICT curricular offerings in K–12 STEM. Most of them fell under the following general category: (1) the ICT curricular offerings in K–12 STEM with regards to the level of reliability of the technological framework; (2) the ICT curricular offerings in K–12 STEM with regards to the level of learning satisfaction of students; and (3) the ICT curricular offerings in K–12 STEM with regards to the level of acceptability of the organizational culture towards maximizing ICT. The top five main issues and challenges identified by the students were the following: (1) The consistency of teacher support in the process of learning ICT restricts students' exposure to other teaching methods and views, limiting their learning outcomes and satisfaction with a 2.54 mean score; (2) The consistency of teacher support in the process of learning ICT makes learners overly dependent on their teachers, limiting their ability to learn, explore, and discover independently with a 2.56 mean score; (3) The student's interactive collaboration with ICT in STEM disciplines is a source of distraction that limits their exposure to other important collaboration skills and negatively impacts learning outcomes with a 2.58 mean score; (4) The student's engagement in ICT-based activities has reduce interaction with teachers as well as peers and do not encourage learning, confidence, or self-esteem with a 2.59 mean score; and (5) The student's perceived relevance of acquired ICT skills limited their exposure to different ICT skills and prevented them from learning other valuable skills with a 2.62 mean score. Student issues and challenges experienced in the ICT curricular offerings in K–12 STEM fall under category (2), which is "The ICT curricular offerings in K–12 STEM with regards to the level of learning satisfaction of students."

The issues and challenges identified by students in the ICT curricular offerings in K–12 STEM, as outlined in Table 13, provide valuable insights into areas requiring attention and improvement. The concerns primarily revolve around the level of learning satisfaction among students, particularly concerning teacher support, collaborative activities, and the perceived relevance of acquired ICT skills.

The top five main issues and challenges identified by students highlight concerns related to their learning satisfaction: The first was the consistency of teacher support. Students express dissatisfaction with the consistency of teacher support in the process of learning ICT, perceiving it as restricting their exposure to alternative teaching methods and views. This issue is particularly significant, as reflected in its low mean score of 2.54. Second were the overly dependent learners: The students feel that consistent teacher support makes them overly dependent on their teachers, limiting their ability to learn, explore, and discover independently. This issue has a mean score of 2.56, indicating a notable concern among students. Third was the distraction from interactive collaboration: students identify interactive collaboration with ICT in STEM disciplines as a source of distraction, limiting their exposure to other essential collaboration skills and negatively impacting learning outcomes. A mean score of 2.58 highlights this issue. Fourth was the reduced interaction with teachers and peers: students note that their engagement in ICT-based activities reduces interaction with teachers and peers, failing to encourage learning, confidence, or self-esteem. Students express this issue with a mean score of 2.59. Fifth was the limited perceived relevance of acquired ICT skills: students perceive a limitation in the relevance of the ICT skills they acquire, hindering their exposure to different ICT skills and preventing them from learning other valuable skills. A mean score of 2.62 captures this issue.

The low mean scores for these issues (ranging from 2.54 to 2.62) indicate a significant level of dissatisfaction and highlight specific pain points within the educational experience. The consistency of teacher support is particularly noteworthy, suggesting a need for improvements in the methods and frequency of support provided to students. The Researcher generated the following suggestive inputs and presumptive conclusions based on the results of the study:

1. **Enhance Teacher Support Consistency.** Address the concerns related to the consistency of teacher support. Implement professional development programs for educators to promote varied teaching methods, encouraging a more dynamic and supportive learning environment.

2. **Promote Independent Learning.** Develop strategies to reduce students' dependency on teachers. Encourage independent exploration and discovery, fostering a culture of self-directed learning that goes beyond traditional teacher-led approaches.

3. **Optimize Interactive Collaboration.** Mitigate distractions arising from interactive collaboration with ICT. Design collaborative activities that align with learning objectives and promote essential collaboration skills while minimizing potential distractions.

4. **Facilitate Increased Interaction.** Counteract the perceived reduction in interaction with teachers and peers resulting from ICT-based activities. Implement approaches that blend technology with personal interaction, ensuring a balanced learning environment that nurtures confidence and self-esteem.

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5. **Enhance Perceived Relevance of ICT Skills.** Reassess and update the ICT curriculum to enhance the perceived relevance of acquired skills. Align the curriculum with industry trends and real-world applications, demonstrating to students the practical value of the skills they are acquiring.

Addressing these identified issues will likely contribute to an improved learning experience and higher satisfaction levels among students in K–12 STEM ICT curricular offerings. Implementing these recommendations requires collaborative efforts from educators, administrators, and curriculum specialists to create a supportive and dynamic learning environment that aligns with students' needs and expectations. Educators, administrators, and curriculum specialists should establish continuous feedback mechanisms to monitor the effectiveness of interventions and make ongoing improvements.

Table 14 provides a summary of issues and challenges experienced by the faculty respondents based on the evaluation of ICT curricular offerings in K–12 STEM. Respondents' evaluations are based on positive statements, and the researcher identified the issues and challenges with the lowest mean score.

Table 14: Issues and Challenges Experienced by the Faculty Respondents in the ICT Curricular Offerings in K-12 STEM

Issues and Challenges	Mean	Verbal Interpretation
1.1.1 is a graduate of IT or has specialized in ICT to teach STEM.	2.92	Agree
2.1.1 limited computer laboratories for the number of students enrolled in the STEM program.	3.06	Agree
2.1.2 have maker spaces and simulation classrooms for STEM-related hands-on activities (such as design planning, programming, electrical and electronics, robotics, mechatronics, etc.).	2.84	Agree
2.1.3 lack an e-classroom that may be used as a lecture hall and a collaborative space for STEM teaching.	2.94	Agree
2.2.1 are regularly revised and contextualized, accessible to the STEM school community, and suitable for ICT competency-based, integrated STEM curriculum.	3.02	Agree
2.2.2 are timely, frequently used, and modified to meet learners' needs.	3.06	Agree
2.2.3 are validated by technology experts, digitally curated, and released as open educational resources.	2.90	Agree
2.3.1 ratio of hardware and digital equipment (desktop computers, laptops, tablets, smart boards, etc.) and software installed to teach ICT to STEM students in the program is insufficient.	3.08	Agree
2.3.2 software used to teach ICT in STEM is open source, always has an updated version, and is compatible with the hardware and other computer devices once installed.	2.98	Agree
2.3.3 network connectivity requirements are inadequate for an integrated discipline approach in a STEM environment, and when used for classroom instruction, it frequently experiences downtime or disruptions and is unreliable on a regular basis.	3.08	Agree

3.1.2 reduce interaction with teachers as well as peers and do not encourage learning, confidence, or self-esteem.	2.59	Agree
3.2.1 limited their exposure to different ICT skills and prevented them from learning other valuable skills.	2.57	Agree
3.2.3 constrained the curriculum's flexibility, so they were less inclined to explore other areas of ICT.	2.71	Agree
3.3.2 encourage an over-reliance on technology, which may limit student diversity.	3.00	Agree
3.4.2 is a source of distraction that limits their exposure to other important collaboration skills and negatively impacts learning outcomes.	2.71	Agree
3.5.1 makes learners overly dependent on their teachers, limiting their ability to learn, explore, and discover independently.	2.53	Agree
3.5.3 restricts students' exposure to other teaching methods and views, limiting their learning outcomes and satisfaction.	2.51	Agree
5.2.2 is hindered by a lack of time, the dread of losing competitive advantage, a lack of trust in colleagues, the absence of incentives or recognition, and a lack of knowledge or expertise.	2.90	Agree
5.4.3 lacks policies, programs, and projects to encourage ICT technical development training for faculty, office staff, and the school community.	2.96	Agree

Table 14 displays the issues and challenges as perceived by the faculty. The Researcher includes issues with a 3.10 or below mean score because, statistically, they received relatively moderate responses and fall under priority issues. The faculty has identified a total of nineteen issues and challenges in the ICT curricular offerings in K–12 STEM. Most of them fell under the following general category: (1) the ICT curricular offerings in K–12 STEM with regards to the level of reliability of the technological framework; (2) the ICT curricular offerings in K–12 STEM with regards to the level of learning satisfaction of students; and (3) the ICT curricular offerings in K–12 STEM with regards to the level of acceptability of the organizational culture towards maximizing ICT. The top five main issues and challenges identified by the faculty were the following: (1) The consistency of teacher support in the process of learning ICT restricts students' exposure to other teaching methods and views, limiting their learning outcomes and satisfaction with a 2.51 mean score; (2) The consistency of teacher support in the process of learning ICT makes learners overly dependent on their teachers, limiting their ability to learn, explore, and discover independently with a 2.53 mean score; (3) The student's interactive collaboration with ICT in STEM disciplines is a source of distraction that limits their exposure to other important collaboration skills and negatively impacts learning outcomes with a 2.57 mean score; (4) The student's engagement in ICT-based activities has reduce interaction with teachers as well as peers and do not encourage learning, confidence, or self-esteem with a 2.59 mean score; (5.1) The student's perceived relevance of acquired ICT skills constrained the curriculum's flexibility, so they were less inclined to explore other areas of ICT with a 2.71 mean score; and (5.1) The student's perceived relevance of acquired ICT skills limited their exposure to different ICT skills and prevented them from learning other valuable skills with a 2.71 mean score. Faculty issues and challenges experienced in the ICT curricular offerings in K–12 STEM fall under category (2), which is "The ICT curricular offerings in K–12 STEM with regards to the level of learning satisfaction of students."

Table 14 outlines the issues and challenges perceived by faculty in the ICT curricular offerings in K–12 STEM. Faculty have clustered the identified issues into three overarching categories: (1) the reliability of the technological framework; (2) the level of learning satisfaction of students; and (3) the acceptability of the organizational culture toward maximizing ICT. The top five challenges highlight concerns related to teacher support, interactive collaboration, and the perceived relevance of acquired ICT skills.

The first was the consistency of teacher support. Faculty members emphasize the restricting impact of inconsistent teacher support on students' exposure to alternative teaching methods. This issue, with a mean score of 2.51, underscores the importance of providing stable and varied support mechanisms to enhance the learning experience. Second were the overly dependent learners: faculty members expressed concern that consistent teacher support leads to learners becoming overly dependent on their teachers (mean score of 2.53). Addressing this issue involves promoting independent learning and fostering a balance between support and self-directed exploration. Third, the students' interactive collaboration with ICT in STEM disciplines (mean score of 2.57) suggests the need to refine collaborative activities to maintain focus and effectiveness. Fourth was the reduced interaction with teachers and peers. Faculty members note that student engagement in ICT-based activities reduces interaction with teachers and peers, negatively impacting learning, confidence, and self-esteem (mean score of 2.59). Balancing the use of technology to encourage meaningful interactions is crucial. Fifth was the perceived relevance of acquired ICT skills: the perceived constraints on the curriculum's flexibility and students' inclination to explore other areas of ICT (mean score of 2.71) point to a need for curriculum adjustments. Offering flexibility and diverse learning opportunities can address this challenge.

The Researcher generated the following suggestive inputs and presumptive conclusions based on the results of the study:

1. **Provide Consistent and Varied Teacher Support.** Develop strategies to ensure consistent and varied teacher support, encouraging diverse teaching methods to enhance student exposure and outcomes.

2. **Promote Independent Learning.** Implement initiatives to foster independent learning among students, balancing teacher support with opportunities for self-directed exploration.

3. **Refine Collaborative Activities.** Review and refine collaborative activities to minimize distractions and maximize the impact of interactive collaboration on learning outcomes.

4. **Balance Technology Use.** Encourage a balanced approach to technology use to prevent reduced interaction with teachers and peers, fostering a positive learning environment.

5. **Enhance Curriculum Flexibility.** Modify the curriculum to offer greater flexibility, enabling students to explore various areas of ICT and develop a broader skill set.

Implementing these suggestive inputs can contribute to an improved learning environment and increased satisfaction levels among students in K–12 STEM ICT curricular offerings. Regular assessments and feedback mechanisms will be essential to gauge the effectiveness of these interventions and guide ongoing improvements.

Table 15 provides a summary of issues and challenges experienced by the administrator respondents based on the evaluation of ICT curricular offerings in K–12 STEM. Respondents' evaluations are based on positive statements, and the researcher identified the issues and challenges with the lowest mean score.

Table 15: Issues and Challenges Experienced by the Administrator Respondents in the ICT Curricular Offerings in K-12 STEM

Issues and Challenges	Mean	Verbal Interpretation
2.3.1 ratio of hardware and digital equipment (desktop computers, laptops, tablets, smart boards, etc.) and software installed to teach ICT to STEM students in the program is insufficient.	3.00	Agree
3.1.2 reduce interaction with teachers as well as peers and do not encourage learning, confidence, or self-esteem.	2.57	Agree

3.2.1 limited their exposure to different ICT skills and prevented them from learning other valuable skills.	2.71	Agree
3.2.3 constrained the curriculum's flexibility, so they were less inclined to explore other areas of ICT.	2.86	Agree
3.3.2 encourage an over-reliance on technology, which may limit student diversity.	2.71	Agree
3.4.2 is a source of distraction that limits their exposure to other important collaboration skills and negatively impacts learning outcomes.	2.43	Agree
3.5.3 restricts students' exposure to other teaching methods and views, limiting their learning outcomes and satisfaction.	2.43	Agree
5.2.2 is hindered by a lack of time, the dread of losing competitive advantage, a lack of trust in colleagues, the absence of incentives or recognition, and a lack of knowledge or expertise.	3.00	Agree
5.4.3 lacks policies, programs, and projects to encourage ICT technical development training for faculty, office staff, and the school community.	3.00	Agree

Table 15 displays the issues and challenges as perceived by the administrators. The researcher includes issues with a 3.10 or below mean score because, statistically, they received relatively moderate responses and fall under priority issues. The administrators have identified a total of nine issues and challenges in the ICT curricular offerings in K–12 STEM. Most of them fell under the following general category: (1) the ICT curricular offerings in K–12 STEM with regards to the level of reliability of the technological framework; (2) the ICT curricular offerings in K–12 STEM with regards to the level of learning satisfaction of students; and (3) the ICT curricular offerings in K–12 STEM with regards to the level of acceptability of the organizational culture towards maximizing ICT. The top five main issues and challenges identified by the administrators were the following: (1.5) The consistency of teacher support in the process of learning ICT restricts students' exposure to other teaching methods and views, limiting their learning outcomes and satisfaction with a 2.43 mean score; (1.5) The student's interactive collaboration with ICT in STEM disciplines is a source of distraction that limits their exposure to other important collaboration skills and negatively impacts learning outcomes with a 2.43 mean score; (3) The student's engagement in ICT-based activities reduces interaction with teachers as well as peers and does not encourage learning, confidence, or self-esteem with a 2.57 mean score; (4.5) The student's perceived relevance of acquired ICT skills limited their exposure to different ICT skills and prevented them from learning other valuable skills with a 2.71 mean score; and (4.5) The student's quality of learning outcomes with the use of ICT encourages an over-reliance on technology, which may limit student diversity with a 2.71 mean score. Administrators' issues and challenges experienced in the ICT curricular offerings in K–12 STEM fall under category (2), which is "The ICT curricular offerings in K–12 STEM with regards to the level of learning satisfaction of students."

Table 15 outlines the issues and challenges perceived by administrators in the ICT curricular offerings in K–12 STEM. Administrators categorize most of the identified challenges based on the level of learning satisfaction of students. Key concerns revolve around teacher support, interactive collaboration, student engagement in ICT-based activities, and the perceived relevance of acquired ICT skills.

The first was the consistency of teacher support. Administrators highlight the restricting impact of inconsistent teacher support on students' exposure to alternative teaching methods, leading to limitations in learning outcomes and satisfaction (mean score: 2.43). Addressing this challenge is crucial for creating a more diverse and effective learning environment. Second, the students' interactive collaboration with ICT in STEM disciplines (mean score: 2.43) suggests a need to refine collaborative activities to maintain focus and enhance learning outcomes. Third was the reduced interaction with teachers and peers: administrators expressed concern about student engagement in ICT-based activities reducing interaction with teachers and peers, negatively affecting learning, confidence, and self-esteem (mean score: 2.57). Strategies to balance technology use and foster meaningful interactions are essential. Fourth was the relevance of the acquired ICT skills: The perceived limitation in exposure to different ICT skills and the prevention of learning other valuable skills (mean score: 2.71) emphasize the importance of offering a more comprehensive and flexible curriculum to meet diverse student needs. Fifth was the quality of learning outcomes and over-reliance on technology: administrators identify concerns about the quality of learning outcomes with the use of ICT, encouraging an over-reliance on technology and potentially limiting student diversity (mean score: 2.71). This issue emphasizes the need for a balanced approach to technology integration in teaching.

The Researcher generated the following suggestive inputs and presumptive conclusions based on the results of the study:

1. **Enhance Consistency in Teacher Support.** Develop strategies to ensure consistent teacher support, fostering varied teaching methods to enhance student exposure and satisfaction.
2. **Refine Interactive Collaboration Activities.** Review and refine collaborative activities to minimize distractions and maximize the impact of interactive collaboration on learning outcomes.
3. **Promote Balanced Technology Use.** Implement policies and practices to promote a balanced approach to technology use, ensuring that ICT-based activities enhance rather than hinder interactions with teachers and peers.
4. **Revise and Enhance the ICT Curriculum.** Collaborate with educators to revise and enhance the ICT curriculum, offering greater flexibility and exposure to a diverse range of ICT skills and applications.
5. **Professional Development for Educators.** Provide professional development opportunities for educators to integrate technology effectively, fostering quality learning outcomes without encouraging over-reliance.

Addressing these suggestive inputs can contribute to an improved learning environment, increased satisfaction among students, and more effective integration of ICT in K–12 STEM curricular offerings. Regular evaluations and adjustments based on feedback will be essential for ongoing improvements.

Table 16 provides a summary of the common issues and challenges experienced by respondents based on the evaluation of ICT curricular offerings in K–12 STEM. Respondents' evaluations are based on positive statements, and they determine the ranking of issues by the lowest average mean score.

Table 16: Summary of the Common Issues and Challenges Experienced by the Respondents in the ICT Curricular Offerings in K-12 STEM

Issues and Challenges	Average Mean	Verbal Interpretation	Rank
2.1 The reliability of the technological framework in terms of the availability of the school's facilities;			
2.1.1 limited computer laboratories for the number of students enrolled in the STEM program	3.27	Agree	**1.5**
2.1.3 lack of e-classroom that may be used as a lecture hall and a collaborative space for STEM teaching	3.10	Agree	**5**
2.3 The reliability of the technological framework in terms of the suitability of ICT infrastructures;			
2.3.1 ratio of hardware and digital equipment (desktop computers, laptops, tablets, smart boards, etc.) and software installed to teach ICT to STEM is insufficient.	3.20	Agree	**4**
	3.27	Agree	**1.5**

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2.3.3 network connectivity requirements are inadequate for an integrated discipline approach in a STEM environment, and when used for classroom instruction, it frequently experiences downtime or disruptions and is unreliable on a regular basis.			
3.1 The student's engagement in ICT-based activities;			
3.1.2 reduce interaction with teachers as well as peers and do not encourage learning, confidence, or self-esteem.	2.73	Agree	**12**
3.2 The student's perceived relevance of acquired ICT skills;			
3.2.1 limited their exposure to different ICT skills and prevented them from learning other valuable skills.	2.85	Agree	**10.5**
3.2.3 constrained the curriculum's flexibility, so they were less inclined to explore other areas of ICT.	2.93	Agree	**9**
3.3 The student's quality of learning outcomes with the use of ICT;			
3.3.2 encourage an over-reliance on technology, which may limit student diversity.	2.94	Agree	**8**
3.4 The student's interactive collaboration with ICT in STEM disciplines;			
3.4.2 is a source of distraction that limits their exposure to other important collaboration skills and negatively impacts learning outcomes.	2.72	Agree	**13**
3.5 The consistency of teacher support in the process of learning ICT;			
3.5.1 makes learners overly dependent on their teachers, limiting their ability to learn, explore, and discover independently.	2.85	Agree	**10.5**
3.5.3 restricts students' exposure to other teaching methods and views, limiting their learning outcomes and satisfaction.	2.66	Agree	**14**
5.2 The organizational culture in terms of harmonious sharing of best practices;			
5.2.2 is hindered by a lack of time, the dread of losing competitive advantage, a lack of trust in colleagues, the absence of incentives or recognition, and a lack of knowledge or expertise.	3.08	Agree	**6**
5.3 The organizational culture in terms of adequacy of supervision and management style;			
5.3.3 technical support and maintenance practices aren't up to date with the latest technology, and any upgrades or improvements are least prioritized and always delayed.	3.26	Agree	**3**
5.4 The organizational culture in terms of the applicability of policy toward organizational goals;			
5.4.3 lacks policies, programs, and projects to encourage ICT technical development training for faculty, office staff, and the school community.	3.04	Agree	**7**

Table 16 provides specific issues for a thorough understanding of the issues and difficulties encountered by different stakeholders involved in K–12 STEM ICT curricula, such as curriculum specialists, school administrators, instructors, and students. The table highlights the list of identified priority issues ranked according to their average mean. Ranking topics by average mean scores shows their perceived relevance. Addressing these issues improves K–12 STEM and ICT education. The categorization of priority topics helps educational institutions identify stakeholder concerns and make focused curriculum modifications.

Based on the conducted evaluation, this study, presents a comprehensive interpretation and analysis of the evaluation of the issues and challenges experienced by the respondents in the ICT curricular offerings in K–12 STEM education. The data highlights several critical aspects that require attention for the development of an effective program plan.

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1. Level of Reliability of the Technological Framework. The evaluation reveals shortcomings in the technological framework, specifically in terms of availability and suitability.

The first was the limited number of computer laboratories. The average mean of 3.27 and a rank of 1.5 indicate a significant concern regarding the insufficient number of computer laboratories for STEM students. The second was the lack of e-classrooms. With an average mean of 3.10 and a rank of 5, the absence of e-classrooms for lectures and collaborative STEM teaching is evident. The third was the insufficient ICT infrastructure. The ratio of hardware and software for teaching ICT to STEM is insufficient, with an average mean of 3.20 and a rank of 4. The fourth issue identified was inadequate network connectivity, which causes frequent downtime or disruptions due to insufficient network connectivity requirements, with an average mean of 3.27 and a rank of 1.5.

2. Level of Learning Satisfaction of Students. The study uncovers issues related to students' engagement, perceived relevance of acquired skills, and quality of learning outcomes with the use of ICT.

First was the reduced engagement: a concerning average mean of 2.73 and a rank of 12 indicate reduced interaction with teachers and peers, negatively impacting learning, confidence, and self-esteem. Second was limited exposure and flexibility: students have limited exposure to different ICT skills (average mean of 2.85, rank 10.5) and face constrained curriculum flexibility, hindering exploration of other ICT areas (average mean of 2.93, rank 9). Third was the over-reliance on technology: the use of ICT encourages over-reliance, potentially limiting student diversity (average mean of 2.94 and a rank of 8). Fourth was a distraction in collaboration: Collaborating interactively with ICT in STEM disciplines negatively impacts important collaboration skills, with an average mean of 2.72 and a rank of 13. Fifth was inconsistent teacher support: inconsistency in teacher support (average mean of 2.85, rank 10.5) makes learners overly dependent on teachers, limiting their ability to learn independently and explore alternative teaching methods (average mean of 2.66, rank 14).

3. Level of Acceptability of Organizational Culture. The study assesses the organizational culture concerning the sharing of best practices, supervision and management style, and the applicability of policies.

First was the hindered sharing of best practices. The average mean of 3.08 and a rank of 6 suggest that the organizational culture hinders the harmonious sharing of best practices due to various challenges such as lack of time, fear of losing competitive advantage, lack of trust, incentives, recognition, and expertise. Second was outdated technical support: technical support and maintenance practices are outdated and delayed, as indicated by an average mean of 3.26 and a rank of 3. Third was the lack of ICT development training policies: the organizational culture lacks policies, programs, and projects to encourage ICT technical development training for faculty, office staff, and the school community (average mean of 3.04, rank 7).

The findings underscore the urgency for a strategic program plan addressing the identified deficiencies in the technological framework, students learning satisfaction, and organizational culture to enhance the overall effectiveness of ICT curricular offerings in K–12 STEM education.

The significance of addressing identified challenges to enhance K–12 STEM ICT education. Educational institutions can obtain significant insights to improve or create new K–12 STEM ICT courses. Resolving

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technological infrastructure concerns is crucial for establishing a strong and stable basis. Enhancing learning satisfaction entails optimizing pedagogical methods and guaranteeing the applicability of STEM courses. It is essential to improve the incorporation of ICT into the organization's culture in order to cultivate a supportive environment. Organizational culture must also better integrate ICT. This suggests that overcoming obstacles requires a conducive atmosphere for ICT integration into education.

Finally, Table 16 shows the particular difficulties addressed by stakeholders in K–12 STEM ICT courses. Educational institutions can use the priority issues to improve or create new programs by addressing technological infrastructure challenges, optimizing pedagogical approaches, and creating a supportive organizational culture. This complex understanding is essential for improving K–12 STEM ICT education.

However, the study "A Formative Evaluation of the Implementation of the K–12 English Program of Public Elementary Schools" found that academics and administrators criticize curriculum execution based on K–12 STEM ICT curricular concerns. Changes in curriculum, teaching methods, learning resources, and student and teacher preparation are tough. Challenges impact curriculum, instruction, and assessment. Interactions occur. A lack of learning materials and infrastructure limits curriculum implementation. DepEd first. According to the study conducted by Ramos-Ulep (2023), administrators and instructors may adopt temporary measures to improve student performance.

Table 17 provides a summary evaluation of the perspectives of education curriculum specialists, administrators, teachers, and learners regarding the faculty's level of competency in delivering ICT curriculum offerings in K–12 STEM. The findings highlight a consensus among students and faculty, but administrators and experts express stronger support for the overall evaluation of the challenges within the K–12 STEM ICT curriculum, particularly concerning faculty competency.

Table 17: Summary Evaluation of the ICT Curriculum Offerings in K–12 STEM with Regard to the Level of Competency of the Faculty

	Student		**Administrator**		**Expert**		**Faculty**	
The ICT curriculum offerings in K-12 STEM with regards to the level of competency of the faculty.	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation
The expertise of faculty in ICT.	3.25	Agree	3.57	Strongly Agree	3.50	Strongly Agree	3.12	Agree
The utilization of ICT facilities and devices.	3.32	Agree	3.81	Strongly Agree	3.39	Agree	3.39	Agree
The competency of the faculty in terms of skills in using ICT.	3.28	Agree	3.71	Strongly Agree	3.61	Strongly Agree	3.30	Agree
The competency of the faculty in terms of attitude towards the use of ICT.	3.42	Agree	4.00	Strongly Agree	3.72	Strongly Agree	3.58	Strongly Agree
Overall	***3.32***	***Agree***	***3.77***	***Strongly Agree***	***3.56***	***Strongly Agree***	***3.35***	***Agree***

Table 17 presents a summary evaluation of the Education Curriculum Specialists, Administrators, Teachers, and Learners regarding "The ICT curriculum offerings in K–12 STEM with regards to the level of competency of the faculty." The findings indicate that both students and faculty agreed with the claims, although administrators and experts strongly supported the overall evaluation of the issues encountered in the K–12 STEM ICT curriculum offerings, specifically with the faculty's level of competency. The administrator reported a mean of 4.00 for "The competency of the faculty in terms of attitude towards the use of ICT," which is the greatest mean. Conversely, the faculty reported a mean of 3.12 for "The expertise of faculty in ICT," which is the lowest mean. However, the student respondents got the lowest overall average mean with a 3.32 value as compared to other groups of respondents.

Table 17 presents a comprehensive evaluation of the Education Curriculum Specialists, Administrators, Teachers, and Learners regarding the level of competency of the faculty in K–12 STEM ICT curriculum offerings. The results reveal a consensus between students and faculty, although administrators and experts express stronger support for the overall assessment, particularly concerning faculty competency.

Administrators provided the highest mean score of 4.00 for "The competency of the faculty in terms of attitude towards the use of ICT." This suggests that administrators perceive a positive attitude among faculty members regarding the integration of ICT in STEM education. On the other hand, faculty members reported a lower mean of 3.12 for "The expertise of faculty in ICT," indicating a comparatively modest self-assessment of their ICT proficiency.

The students' responses yielded the lowest overall average mean of 3.32 compared to other respondent groups. This suggests that students are less optimistic or satisfied with the faculty's competency in ICT. The lower mean from students might indicate a perceived gap between their expectations and the actual proficiency of faculty members in utilizing ICT in STEM education.

The disparities in mean scores among the respondent groups highlight potential areas for improvement in the K–12 STEM ICT curriculum offerings. The alignment in perspectives between faculty and students, despite differences in mean scores, suggests a shared understanding of certain challenges or strengths within the curriculum.

To sum it all up, while there is a general agreement among students, faculty, administrators, and experts regarding the competency of faculty in K–12 STEM ICT curriculum offerings, there are nuanced differences in their assessments. The study's results provide valuable insights into areas that may need attention or improvement, offering a foundation for further discussion and potential refinements in the ICT curriculum to better meet the expectations and needs of all stakeholders involved.

Table 18 presents a summary evaluation of the level of reliability of the technological framework in K–12 STEM ICT curriculum offerings, as assessed by Education Curriculum Specialists, Administrators, Teachers, and Learners. The overall findings indicate a general agreement among participants on the comprehensive assessment of ICT curriculum offerings in K–12 STEM, with a specific focus on the reliability of the technological framework.

Table 18: Summary Evaluation of the ICT Curriculum Offerings in K–12 STEM with Regard to the Level of Reliability of the Technological Framework

	Student		**Administrator**		**Expert**		**Faculty**	
The ICT curriculum offerings in K-12 STEM with regards to the level of reliability of the technological framework.	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation
The reliability of the technological framework in terms of the availability of facilities	2.98	Agree	3.24	Agree	3.39	Agree	2.95	Agree

The reliability of the technological framework in terms of access to ICT resources.	3.19	Agree	3.48	Agree	3.33	Agree	2.99	Agree
The reliability of the technological framework in terms of suitability of ICT infrastructures	3.05	Agree	3.19	Agree	3.39	Agree	3.05	Agree
Overall	***3.07***	***Agree***	***3.30***	***Agree***	***3.37***	***Agree***	***3.00***	***Agree***

Table 18 provides a summary evaluation of the level of reliability of the technological framework in K–12 STEM ICT curriculum offerings, as evaluated by Education Curriculum Specialists, Administrators, Teachers, and Learners. The findings suggest that the participants agreed with the comprehensive assessment of the ICT curriculum offerings in K–12 STEM, specifically on the dependability of the technological framework. The administrator recorded the highest average score of 3.48 for "The reliability of the technological framework with the accessibility of ICT resources," whereas the faculty recorded the lowest overall average mean of 3.00 and an average score of 2.95 for "The reliability of the technological framework concerning the availability of facilities," close to the student's average score of 2.98.

Table 18 presents a summarized evaluation of the level of reliability of the technological framework in K–12 STEM ICT curriculum offerings, as assessed by Education Curriculum Specialists, Administrators, Teachers, and Learners. The findings indicate a consensus among participants regarding the dependability of the technological framework, with variations in their assessments.

Administrators provided the highest average score of 3.48, particularly in the aspect of "The reliability of the technological framework with the accessibility of ICT resources." This suggests that administrators perceive the technological infrastructure, especially in terms of accessibility to ICT resources, as reliable and robust.

In contrast, faculty members recorded the lowest overall average mean of 3.00, with a specific point of concern being "The reliability of the technological framework concerning the availability of facilities," where they reported an average score of 2.95. This indicates a comparatively lower level of confidence among faculty members in the reliability of facilities supporting the ICT curriculum in K–12 STEM education.

The students' average score of 2.98 falls close to the faculty's score, suggesting a similar perception of the technological framework's reliability concerning the availability of facilities. The alignment in scores between faculty and students indicates a shared perspective on potential challenges or shortcomings in the technological infrastructure, specifically related to the availability of facilities.

To sum it all up, while there is broad agreement among participants on the reliability of the technological framework in K–12 STEM ICT curriculum offerings, the variations in scores highlight specific areas of concern. The discrepancies between administrator, faculty, and student assessments suggest potential areas for improvement in facilities supporting the ICT curriculum. These insights can guide further investigation and targeted interventions to enhance the reliability of the technological framework, ensuring a more effective and dependable ICT education experience for all stakeholders involved in K–12 STEM education.

The analysis of Table 18 provides insights into the participants' perspectives on the reliability of the technological framework in K–12 STEM ICT curriculum offerings. The findings can inform institutions about the perceived strengths and areas for enhancement in the technological infrastructure supporting ICT education. Addressing concerns related to the availability of facilities, as identified by faculty members and students, could be a key consideration for improving the overall trustworthiness of the technological framework in K–12 STEM education.

Table 19 provides a summarized evaluation of Education Curriculum Specialists, Administrators, Teachers, and Learners' perspectives on "ICT Curriculum Offerings in K–12 STEM" concerning the degree of student

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satisfaction with their learning experience. The findings indicate a general agreement among participants regarding the overall evaluation of ICT curriculum offerings in K–12 STEM, particularly concerning the acceptance of student learning satisfaction.

Table 19: Summary Evaluation of the ICT Curriculum Offerings in K–12 STEM with Regard to the Level of Acceptability of the Learning Satisfaction of Students

	Student		**Administrator**		**Expert**		**Faculty**	
The ICT curriculum offerings in K-12 STEM with regards to the level of learning satisfaction of students.	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation
The student's engagement in ICT-based activities	3.11	Agree	3.19	Agree	3.33	Agree	3.09	Agree
The student's perceived relevance of acquired ICT skills	2.90	Agree	3.05	Agree	3.44	Agree	2.88	Agree
The student's quality of learning outcomes with the use of ICT	3.17	Agree	3.29	Agree	3.28	Agree	3.22	Agree
The student's interactive collaboration with ICT in STEM disciplines	3.11	Agree	3.29	Agree	3.39	Agree	3.19	Agree
The consistency of teacher support in the process of learning ICT	2.81	Agree	3.14	Agree	3.22	Agree	2.82	Agree
Overall	***3.02***	***Agree***	***3.19***	***Agree***	***3.33***	***Agree***	***3.04***	***Agree***

Table 19 presents a summarized evaluation of Education Curriculum Specialists, Administrators, Teachers, and Learners' perspectives on the "ICT Curriculum Offerings in K–12 STEM" concerning the degree of student satisfaction with their learning experience. The findings suggest that participants agreed with the overall evaluation of the ICT curriculum offerings in K–12 STEM, specifically with the degree of acceptance of student learning satisfaction. The Expert group had the highest average score of 3.44 for "The student's perceived relevance of acquired ICT skills," but the Faculty group had the lowest average score of 2.82 for "The consistency of teacher support in the process of learning ICT." However, the student respondents got the lowest overall average mean of 3.02 as compared to the other group of respondents.

Table 19 provides a summarized evaluation of the perspectives of Education Curriculum Specialists, Administrators, Teachers, and Learners regarding the "ICT Curriculum Offerings in K–12 STEM," focusing on the degree of student satisfaction with their learning experience. The findings suggest a general agreement among participants on the overall evaluation of the ICT curriculum offerings, particularly in terms of student satisfaction, although there are notable variations in their assessments.

The expert group recorded the highest average score of 3.44 for "The student's perceived relevance of acquired ICT skills." This indicates that experts believe students find the ICT skills acquired through the curriculum to be highly relevant. This positive perception from experts suggests a strong alignment between the curriculum's objectives and the perceived needs of students in terms of practical relevance.

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On the other hand, the faculty group reported the lowest average score of 2.82, specifically for "The consistency of teacher support in the process of learning ICT." Faculty members perceive a potential inconsistency in the support provided to students during their ICT learning process. The lower score suggests an area that may need attention in terms of enhancing the consistency of teacher support.

Notably, the student respondents reported the lowest overall average mean of 3.02 compared to other groups of respondents. This suggests that, on average, students are less satisfied with their learning experience in the ICT curriculum. These lower scores from students may suggest areas for improvement to enhance their satisfaction levels.

To sum it all up, the study indicates a broad consensus among participants regarding the ICT curriculum offerings in K–12 STEM, specifically in terms of student satisfaction. However, the variations in scores among different respondent groups, especially the lower satisfaction reported by students, highlight specific areas that may require attention and improvement. These insights can guide curriculum adjustments and support strategies to enhance the overall learning experience and satisfaction levels of students in the K–12 STEM ICT curriculum.

The analysis of Table 19 provides insights into the stakeholders' perspectives on student satisfaction with ICT curriculum offerings in K–12 STEM. The findings can guide educational institutions in understanding areas of strength and potential improvement, particularly in terms of teacher support consistency, to enhance the overall quality of the learning experience in K–12 STEM ICT education.

Table 20 presents a summary evaluation of Education Curriculum Specialists, Administrators, Teachers, and Learners regarding the suitability of ICT curriculum offerings in K–12 STEM education for creating an appropriate STEM education environment. The analysis indicates variations in the degree of agreement among different stakeholder groups.

Table 20: Summary Evaluation of the Relevance of the ICT Curriculum Offerings in K–12 STEM with Regard to the Level of Appropriateness of STEM Education Environment

	Student		**Administrator**		**Expert**		**Faculty**	
The relevance of the ICT curriculum offerings in K-12 STEM with regards to the level of appropriateness of STEM education environment.	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation
The appropriateness of ICT integration	3.37	Agree	3.71	Strongly Agree	3.50	Strongly Agree	3.42	Agree
The accuracy of the learning assessments in ICT.	3.26	Agree	3.67	Strongly Agree	3.39	Agree	3.27	Agree
The thoroughness of the learning experiences in ICT.	3.31	Agree	3.67	Strongly Agree	3.39	Agree	3.42	Agree
The correctness of the methods in delivering instructions in ICT	3.29	Agree	3.57	Strongly Agree	3.61	Strongly Agree	3.38	Agree
Overall	***3.31***	***Agree***	***3.65***	***Strongly Agree***	***3.47***	***Agree***	***3.37***	***Agree***

Table 20 presents a summary evaluation of Education Curriculum Specialists, Administrators, Teachers, and Learners regarding the level of relevance appropriate to the STEM education environment to the ICT curriculum offerings. The results indicate that Administrators and Experts expressed a high degree of agreement, while

Students and Faculty expressed a moderate level of agreement, on the overall evaluation of the relevance of the ICT curriculum offerings in the K–12 STEM environment. This evaluation specifically pertains to the appropriateness of the STEM education environment. The administrators reported the highest mean score of 3.71 for "The appropriateness of ICT integration," while the students reported the lowest overall average mean of 3.31, followed by the faculty with 3.37. The students also got the lowest mean score of 3.26 for "The accuracy of the learning assessments in ICT."

Table 20 presents a summarized evaluation of perspectives from Education Curriculum Specialists, Administrators, Teachers, and Learners regarding the relevance of ICT curriculum offerings in the K–12 STEM environment. The findings indicate varying degrees of agreement among participant groups, with Administrators and Experts expressing higher levels of agreement compared to Students and Faculty.

Administrators reported the highest mean score of 3.71 for "The appropriateness of ICT integration," suggesting that administrators perceive a high level of suitability in integrating ICT into the STEM education environment. This positive evaluation from administrators highlights their confidence in the alignment of the ICT curriculum with the STEM educational context. Experts also expressed a high degree of agreement, indicating that individuals with specialized knowledge in curriculum development find the ICT curriculum offerings highly relevant to the STEM environment.

On the other hand, students and faculty expressed a moderate level of agreement, with students reporting the lowest overall average mean of 3.31 and faculty following closely with 3.37. This suggests that, on average, both students and faculty view the relevance of ICT curriculum offerings in the STEM environment with a moderate level of agreement.

The lowest mean score for students, specifically 3.26 for "The accuracy of the learning assessments in ICT," indicates a specific area of concern. This implies that students perceive room for improvement in the precision of assessments within the ICT curriculum.

To sum it all up, the study suggests that administrators and experts have a more positive evaluation of the relevance of ICT curriculum offerings in the K–12 STEM environment compared to students and faculty. The variations in mean scores, especially the lower scores from students and faculty, highlight potential areas for enhancement, such as improving the accuracy of learning assessments in ICT. These insights can guide refinements in the ICT curriculum to better align with the expectations and needs of all stakeholders in the K–12 STEM education environment.

The analysis of Table 20 shows that different stakeholder groups have different levels of agreement about how well the ICT-based K–12 STEM curriculum works for creating a good STEM learning environment. While administrators and experts generally express a high level of agreement, students and faculty members show a more moderate level of agreement, indicating potential areas for further exploration and enhancement in the ICT curriculum. The specific issues raised by students, such as the accuracy of learning assessments in ICT, can guide targeted improvements to better align the curriculum with student needs and expectations.

Table 21 provides a summarized evaluation of Education Curriculum Specialists, Administrators, Teachers, and Learners regarding their perceptions of the level of acceptability of the organizational culture towards maximizing ICT. The analysis reveals varying degrees of agreement among different stakeholder groups.

Table 21: Summary Evaluation for Acceptability of the Organizational Culture Towards Maximizing ICT

	Student		**Administrator**		**Expert**		**Faculty**	
The ICT curriculum offerings in K-12 STEM with regards to the level of Acceptability of the	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation	Mean	Verbal Interpretation

organizational culture towards maximizing ICT								
The organizational culture's admissibility of beliefs and ideologies	3.34	Agree	3.76	Strongly Agree	3.56	Strongly Agree	3.41	Agree
The organizational culture in terms of harmonious sharing of best practices	3.09	Agree	3.43	Agree	3.56	Strongly Agree	3.13	Agree
The organizational culture in terms of adequacy of supervision and management style	3.14	Agree	3.52	Strongly Agree	3.56	Strongly Agree	3.15	Agree
The organizational culture in terms of the applicability of policy toward organizational goals	3.07	Agree	3.38	Agree	3.39	Agree	3.10	Agree
Overall	***3.10***	***Agree***	***3.44***	***Agree***	***3.50***	***Strongly Agree***	***3.13***	***Agree***

Table 21 presents a summary evaluation of the Education Curriculum Specialists, Administrators, Teachers, and Learners' perceptions of the suitability of the organizational culture for optimizing the use of ICT. The results indicate that Administrators and Experts expressed a high level of agreement, while Students and Faculty expressed a moderate level of agreement in their evaluation of the acceptability of the organizational culture in terms of maximizing ICT. Among the administrators, the highest average score is 3.7 for "The organizational culture's acceptance of beliefs and ideologies," while among students, the lowest average score is 3.07 for "The organizational culture in terms of the applicability of policy towards organizational goals." The student respondents got the lowest overall average mean of 3.10, followed by the faculty with 3.13.

Table 21 provides a summarized evaluation of the perceptions of Education Curriculum Specialists, Administrators, Teachers, and Learners regarding the suitability of the organizational culture for optimizing the use of ICT. The results indicate varying degrees of agreement among participant groups, with Administrators and Experts expressing higher levels of agreement compared to Students and Faculty.

Administrators reported the highest average score of 3.7 for "The organizational culture's acceptance of beliefs and ideologies." This suggests that administrators perceive a high level of acceptance within the organizational culture for the beliefs and ideologies related to the use of ICT. This positive evaluation from administrators points to a supportive cultural environment that aligns with the goals and values associated with ICT integration. Experts, similarly, expressed a high level of agreement, indicating that individuals with specialized knowledge in education and curriculum development find the organizational culture conducive to optimizing the use of ICT.

On the other hand, students and faculty expressed a moderate level of agreement, with students reporting the lowest overall average mean of 3.10, followed closely by faculty with 3.13. This suggests that, on average, both students and faculty view the organizational culture's suitability for maximizing ICT with a moderate level of agreement.

The lowest mean score for students, specifically 3.07 for "The organizational culture in terms of the applicability of policy towards organizational goals," points to a specific aspect of concern. This implies that students perceive a need for improvement in how organizational policies align with overall goals regarding the use of ICT.

To sum it all up, the study suggests that administrators and experts have a more positive evaluation of the organizational culture's suitability for optimizing ICT compared to students and faculty. The variations in mean scores, especially the lower scores from students and faculty, highlight specific areas for improvement, such as

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aligning policies with organizational goals related to ICT. These insights can guide efforts to foster a more supportive organizational culture for effective ICT integration in the educational context.

The analysis of Table 21 highlights varying perceptions among different stakeholder groups regarding the suitability of the organizational culture for optimizing the use of ICT. While administrators and experts generally express a high level of agreement, students and faculty members show a more moderate level of agreement, indicating potential areas for improvement in the organizational culture to better support the effective use of ICT. Addressing concerns raised by students, such as the effectiveness of policies in achieving organizational goals, can guide targeted improvements to enhance the overall ICT integration culture.

Table 22 presents the results from the test of normality, as assessed through both the Kolmogorov-Smirnov and Shapiro-Wilk tests, providing insights into the distribution of the data in your study.

The Significant Difference with the Issues in ICT Curricular Offering in K – 12 STEM as Perceived by the Respondents

Table 22: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
"THE ICT CURRICULUM PROGRAM OFFERINGS IN K-12 STEM EVALUATION INDICATORS "	.107	212	.000	.972	212	.000

a. Lilliefors Significance Correction

The table shows that all variables are not Normal, with a Sig value less than 0.05. Therefore, the researcher used non-parametric tests.

The Kolmogorov-Smirnovlow test, with a p-value of 0.000, suggests that the data significantly deviates from a normal distribution. This may indicate that the data might not follow a perfectly normal distribution.

The Shapiro-Wilk test, with a p-value of 0.000, also indicates that the data significantly deviates from a normal distribution.

The low p-values from both tests strongly suggest that the data does not follow a normal distribution. This departure from normality may impact the use of certain statistical analyses that assume normality. The Researcher was cautious when interpreting results based on assumptions of normality and considered alternative statistical methods suitable for non-normally distributed data.

In summary, the test of normality results from both the Kolmogorov-Smirnov and Shapiro-Wilk tests indicate a significant departure from a normal distribution. This study considered employing non-parametric statistical methods or transforming the data if normality is crucial for the chosen statistical analysis.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of "THE ICT CURRICULUM PROGRAM OFFERINGS IN K-12 STEM EVALUATION INDICATORS " is the same across categories of Group of the sample population.	Independent-Samples Kruskal-Wallis Test	.019	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 23: Ranks

Group of the sample population		N	Mean Rank
"THE ICT CURRICULUM PROGRAM OFFERINGS IN K-12 STEM EVALUATION INDICATORS "	Student	686	371.66
	Expert	7	591.07
	Administrator	7	511.43
	Faculty	51	386.27
	Total	751	

The table indicates the group of the sample population and the respondents representation in the study.

Table 24: Test Statistics[a,b]

	"THE ICT CURRICULUM PROGRAM OFFERINGS IN K-12 STEM EVALUATION INDICATORS "
Chi-Square	10.006
df	3
Asymp. Sig.	.019

a. Kruskal Wallis Test

b. Grouping Variable: Group of the sample population

Table 24 shows the significant difference among the issues in ICT curricular offerings in K-12 STEM as perceived by the respondents. The result provides significant observations regarding the perceived distinctions across different stakeholder groups (Students, Experts, Administrators, and Faculty) while evaluating ICT curriculum offerings in K-12 STEM. The computed alpha (α) value of 0.019, which is lower than the standard significance criterion of 0.05, indicates significant differences. These differences reveal notable variations in the evaluation of the ICT curricular program offered among these groups.

The significance of the differences implies that distinct stakeholder groups hold varying perspectives on the issues related to ICT curricular offerings. The observed variations highlight the importance of considering diverse viewpoints to gain a comprehensive understanding of the strengths and weaknesses of the program.

Identifying these differences can be instrumental in tailoring interventions and improvements to address the specific concerns raised by each stakeholder group. For instance, if Students, Faculty, Administrators, and Experts differ significantly in their evaluations, it may indicate the need for targeted measures to enhance the program's effectiveness based on the unique expectations and experiences of each group.

The findings from Table 24 underscore the complexity of assessing the ICT curricular offerings in K–12 STEM, emphasizing the importance of engaging multiple perspectives to inform strategic decisions and improvements. The noted distinctions provide valuable insights for educational institutions to refine and optimize their ICT curricular programs, ensuring alignment with the expectations and needs of various stakeholders.

The Program Plan in ICT Developed Based on the Results of the Study

The study findings indicate the necessity of developing two different proposals for the suggested inputs in order to provide a framework for ICT program planning. The study of the issues experienced in the ICT curricular offerings in K–12 STEM reveals that there was a statistical equivalence between the respondents who were

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curriculum experts and school administrators. Similarly, there was a statistical equivalence between the respondents, who were faculty members and students. The Researcher devised two distinct recommendations tailored to address the specific challenges faced by the participants. This will facilitate their ability to address future issues. The recommended inputs for the formulation of an ICT program planning framework consist of the following elements: encountered issues, categorized elements, program inputs, goals and objectives, program outcomes, implementation strategies, involved individuals, duration, monitoring and evaluation, and source of funds. Displayed below are screenshots of the suggestions.

Figure 4: Experts' and School Administrators Proposed Inputs for ICT Program Plan

Source: DepEd Order No. 44 Series of 2015 (Guidelines on the Enhanced School Improvement Planning (SIP) Process and the School Report Card (SRC)

PROPOSED INPUTS FOR DEVELOPMENT OF FRAMEWORK IN ICT PROGRAM PLANNING

Curriculum Experts' and School Administrators' Perspective Based on Issues Experienced in ICT Curricular Offerings in the K – 12 STEM

ISSUE/S ENCOUNTERED	ELEMENTS CATEGORY	PROGRAM INPUTS	GOALS/OBJECTIVES	TARGET OUTCOMES	IMPLEMENTATION STRATEGIES	PERSON/S INVOLVED	DURATION	MONITORING AND EVALUATION	SOURCE OF FUNDS
The ICT Curricular Offerings in K-12 STEM with regards to the Level of Reliability of the Technological Infrastructure Framework 1. The reliability of the technological framework in terms of the availability of the school's facilities. • Limited computer laboratories for the number of students enrolled in the STEM program • Lack of e-classroom that may be used as a lecture hall and a collaborative space for STEM teaching 2. The reliability of the technological framework in terms of the suitability of ICT infrastructures. • The ratio of hardware and digital equipment (desktop computers, laptops, tablets, smart boards, etc.) and software installed to teach ICT to STEM is insufficient. • Network connectivity requirements are inadequate for an	• Leadership and Management • Resources • Extending Opportunities for Learning	• **Program Title:** Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability	These objectives provide a clear, measurable path toward achieving the broader goals of the program. They help guide the development and implementation of specific initiatives to enhance technological reliability and resource suitability. **Program Goals:** 1. **Improved Facility Availability:** To enhance the availability and accessibility of facilities for users through a more reliable technological framework. 2. **Enhanced Technological Reliability:** To increase the overall reliability of the technological infrastructure, reducing system downtime and unplanned interruptions. 3. **User Satisfaction:** To improve user satisfaction by ensuring	These target outcomes provide a clear direction for the program and measurable criteria for success. They should be tracked and evaluated at regular intervals to ensure the program is on track to achieve its objectives. 1. **Improved Facility Availability**: ▪ Achieve at least a 95% increase in the availability of facilities by the end of the program. ▪ Reduce facility downtime by 50% through enhanced technological infrastructure and redundancy measures. ▪ Minimize service interruptions to ensure facilities are accessible 24/7. 2. **Enhanced Reliability**: ▪ Increase system reliability and uptime, achieving an uptime rate of 99.9% or higher. ▪ Decrease the number of unplanned outages and system failures by 80% within the program's timeframe. ▪ Implement monitoring and maintenance	These implementation strategies are essential for achieving the program's goals and objectives. They provide a roadmap for addressing challenges related to technological framework reliability, facility availability, and suitability for users. **1. Comprehensive Infrastructure Assessment:** • Strategy: Conduct a thorough assessment of the existing technological infrastructure, including hardware, software, and networking components. • Rationale: This analysis will help identify weaknesses and gaps that need to be addressed to improve reliability and suitability. **2. Infrastructure Upgrades and Redundancy Measures:** • Strategy: Develop a roadmap for upgrading outdated hardware, enhancing software systems, and implementing redundancy measures.	• Curriculum Experts in ICT • Technical Experts in ICT • Division Schools Superintendent • Division Information Technology Officer • School Administrators • School ICT Coordinators • Faculty	This timeline is a general guideline and can be adjusted based on the complexity of the infrastructure and the specific objectives of your organization. Regular assessments and adaptations will ensure the program remains aligned with the evolving needs of users and the organization's goals. **Program Timeline:** Creating a program timeline will depend on the specific needs and scope of your organization, but here's a general outline for the "Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability" program: **Year 1: Program Inception and Assessment** • Months 1-3: Program Initiation ○ Establish the program team,	Annual Monitoring, Evaluation, and Proactive Maintenance: This timeline provides a structured approach to monitoring and evaluating the program's progress and outcomes. Regular feedback loops and data-driven decision-making are crucial for making adjustments and ensuring the long-term success of the program. Monitoring and evaluation are essential for ensuring the success of your program. Here's a possible program monitoring and evaluation timeline for "Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability":	• DepEd Central Office • LGU • Sponsorship from Stakeholders

Study's Modified Template for School Improvement Plan Anchored on DepEd Order No. 44 Series of 2015

Source: DepEd Order No. 44 Series of 2015 (Guidelines on the Enhanced School Improvement Planning (SIP) Process and the School Report Card (SRC)

integrated discipline approach in a STEM environment, and when used for classroom instruction, it frequently experiences downtime or disruptions and is unreliable on a regular basis.			that the ICT resources are available, reliable, and suited to their needs. 4. **Efficient Resource Utilization:** To optimize resource usage and scalability, allowing for the efficient allocation of resources to meet varying demands. 5. **Enhanced Learning:** For programs related to education or training, a goal could be to enrich the learning experience by ensuring the suitability and accessibility of ICT learning resources. **Program Objectives:** **1. Enhanced Facility Availability:** ○ Achieve a 95% or higher availability rate for all critical facilities. ○ Reduce unscheduled facility downtimes by at least 50% within one year. **2. Improved Technological Reliability:** ○ Achieve an uptime rate of 99.9% or higher for all critical ICT systems. ○ Implement real-time monitoring to identify and	procedures that ensure proactive identification and resolution of potential issues. 3. **Improved User Satisfaction**: ▪ Survey users to measure their satisfaction with facility availability and system reliability, aiming for at least an 85% user satisfaction rate. ▪ Gather regular feedback from users to continuously improve the system and adapt to their needs. 4. **Enhanced Network Performance**: ▪ Optimize network performance to achieve a reduction in latency and improved data transfer speeds. ▪ Implement load-balancing mechanisms to distribute traffic evenly, resulting in faster access to facilities. ▪ Enhance network scalability to accommodate growth, ensuring no performance degradation as user numbers increase. 5. **Effective Disaster Recovery**: ▪ Develop and test a disaster recovery plan, achieving a recovery time objective (RTO) of no more than 4 hours. ▪ Ensure data backup and recovery procedures are in	• Rationale: Upgrades and redundancy will bolster the system's reliability, reducing downtime and improving facility availability. **3. Network Optimization:** • Strategy: Optimize the network infrastructure to reduce latency, increase data transfer speeds, and improve overall performance. • Rationale: A well-optimized network ensures that facilities can be accessed swiftly and without interruptions. **4. Proactive Maintenance and Monitoring:** • Strategy: Implement a proactive maintenance schedule and real-time monitoring systems to identify potential issues. • Rationale: This approach minimizes the risk of unscheduled downtime and ensures quick issue resolution. **5. Disaster Recovery and Business Continuity:** • Strategy: Develop a robust disaster recovery plan with regularly tested backup and recovery procedures. • Rationale: Ensuring data and system recovery in		including project managers, IT specialists, and stakeholders. ○ Define program objectives, goals, and key performance indicators (KPIs). ○ Develop a detailed project plan, budget, and resource allocation. • Months 4-6: Infrastructure Assessment ○ Conduct a comprehensive assessment of the existing technological infrastructure. ○ Identify weaknesses and gaps in the current framework. ○ Initiate discussions with external partners and vendors for potential collaborations. • Months 7-9: Planning and Roadmap Development ○ Develop a roadmap for infrastructure upgrades and redundancy measures. ○ Plan for network optimization and scalability enhancements.	**Year 1: Baseline Assessment and Planning** • Months 1-3: Program Initiation and Baseline Assessment ○ Establish a baseline for facility availability, technological reliability, and user satisfaction. ○ Develop monitoring and evaluation (M&E) frameworks and key performance indicators (KPIs). ○ Set up data collection mechanisms and tools. • Months 4-6: M&E Plan Development ○ Create a detailed M&E plan, including data collection methods, sources, and frequency. ○ Establish a dedicated M&E team or designate responsibilities within the program team. ○ Ensure that the M&E plan aligns with program goals and objectives.	

Study's Modified Template for School Improvement Plan Anchored on DepEd Order No. 44 Series of 2015

Figure 4 shows the study's recommended inputs based on evaluating the various critical difficulties that curriculum specialists and school administrators encountered in K–12 STEM ICT curricular offerings.

The study found that ICT curriculum difficulties demand a comprehensive and coordinated approach. This method should emphasize defined goals, strategic implementation, and rigorous monitoring and assessment. The comments from curriculum experts and school administrators were used to create a comprehensive ICT Program Plan that addresses the complicated issues in ICT education. Here's the link for a clear copy of the image: https://tinyurl.com/InputsExpertAdmin

Figure 5**:** Faculty and Students Proposed Inputs for ICT Program Plan

Source: DepEd Order No. 44 Series of 2015 (Guidelines on the Enhanced School Improvement Planning (SIP) Process and the School Report Card (SRC)

PROPOSED INPUTS FOR DEVELOPMENT OF FRAMEWORK IN ICT PROGRAM PLANNING
Faculty and Students' Perspective Based on Issues Experienced in ICT Curricular Offerings in the K – 12 STEM

ISSUE/S ENCOUNTERED	ELEMENTS CATEGORY	PROGRAM INPUTS	GOALS/OBJECTIVES	TARGET OUTCOMES	IMPLEMENTATION STRATEGIES	PERSON/S INVOLVED	DURATION	MONITORING AND EVALUATION	SOURCE OF FUNDS
The ICT Curricular Offerings in K-12 STEM with regards to the Level of Reliability of the Technological Infrastructure Framework 1. The reliability of the technological framework in terms of the availability of the school's facilities. • Limited computer laboratories for the number of students enrolled in the STEM program • Lack of e-classroom that may be used as a lecture hall and a collaborative space for STEM teaching 2. The reliability of the technological framework in terms of the suitability of ICT infrastructures. • The ratio of hardware and digital equipment (desktop computers, laptops, tablets, smart boards, etc.) and software installed to teach ICT to STEM is insufficient. • Network connectivity requirements are inadequate for an integrated discipline approach in a STEM	• Teaching and Learning • Resources • Learning Outcomes • Extending Opportunities for Learning	• **Program Title:** Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability	By considering both faculty and student perspectives, the program can be designed to cater to the needs and expectations of all stakeholders, leading to a well-rounded and effective educational experience. Here are the program goals and objectives for the program entitled "Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability" from both perspectives: ***Faculty Perspective:*** **Program Goals:** 1. Enhance faculty expertise and knowledge in technological framework reliability and suitability improvements. 2. Foster collaboration among faculty members to conduct research and contribute to the field. 3. Develop a curriculum that reflects the latest advancements in technological framework reliability.	These target outcomes provide a clear direction for the program and measurable criteria for success. They should be tracked and evaluated at regular intervals to ensure the program is on track to achieve its objectives. Defining target outcomes from both faculty and students' perspectives is crucial for assessing the success of the program "Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability." Here are the target outcomes from both perspectives. ***Faculty Perspective:*** **1. Research Contribution:** Faculty members should contribute to the body of knowledge in technological framework reliability and suitability, with the goal of publishing a set number of research papers or participating in relevant conferences annually.	By considering both faculty and student perspectives in the program's implementation strategy, it can create a holistic approach that addresses the needs and expectations of all stakeholders, ultimately leading to a successful program. To implement the program "Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability" successfully, it's essential to consider strategies from both faculty and students' perspectives. Here are program implementation strategies from each viewpoint: ***Faculty Perspective:*** **1. Faculty Development:** Invest in ongoing faculty development programs to ensure they remain current with the latest advancements in technological framework reliability and suitability. Encourage faculty to attend workshops, seminars, and	• Curriculum Experts in ICT • Technical Experts in ICT Education • Division Schools Superintendent • Education Program Supervisor • Division Information Technology Officer • School Administrators • School ICT Coordinators • Faculty • Students	This timeline ensures a gradual progression of activities for both faculty and students, with a focus on faculty development, curriculum improvement, and research in the initial years, and hands-on learning, extracurricular engagement, and career preparation for students over the course of their program. Regular feedback and assessment loops are integrated to facilitate continuous improvement from both perspectives. Creating a program timeline that takes into account both faculty and students' perspectives is essential to ensuring that the program's activities and milestones align with the needs of both groups.	**Annual Monitoring and Evaluation** By combining these monitoring and evaluation mechanisms from both faculty and students' perspectives, the program can continually assess its strengths and weaknesses, make data-driven improvements, and ensure that it is meeting the needs and expectations of both groups effectively. This holistic approach contributes to the ongoing success of the program. A robust program monitoring and evaluation mechanism is crucial for assessing the effectiveness and quality of the program "Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability." Here's a mechanism from both	• DepEd Central Office • DepEd Regional Office • DepEd Division Office • Schools • LGU • Sponsorship from the Stakeholders

Study's Modified Template for School Improvement Plan Anchored on DepEd Order No. 44 Series of 2015

Source: DepEd Order No. 44 Series of 2015 (Guidelines on the Enhanced School Improvement Planning (SIP) Process and the School Report Card (SRC)

environment, and when used for classroom instruction, it frequently experiences downtime or disruptions and is unreliable on a regular basis.			**Program Objectives:** 1. Provide faculty with access to training and resources to stay current in the field. 2. Establish regular faculty meetings and seminars to encourage research collaboration. 3. Review and update the curriculum to include cutting-edge technologies and methodologies. 4. Encourage faculty to publish research papers and participate in relevant conferences. ***Student Perspective:*** **Program Goals:** 1. Equip students with the skills and knowledge required to enhance technological framework reliability and facility availability. 2. Offer practical experiences and opportunities for students to apply their learning. 3. Prepare students for successful careers in the field. **Program Objectives:** 1. Deliver engaging and up-to-date course content that aligns with industry demands.	**2. Curriculum Enhancement:** Regularly update and improve the program's curriculum to ensure it reflects the latest advancements and best practices in the field. This may involve the introduction of new courses or the modification of existing ones. **3. Faculty Collaboration:** Encourage faculty members to actively collaborate on research projects, grant applications, and joint publications, aiming for a certain number of collaborative initiatives each year. **4. Student Mentoring:** Provide mentorship and guidance to students, ensuring that a designated number of students engage in research projects under faculty supervision. ***Student Perspective:*** **1. Skills Development:** Students should acquire a specific set of skills related to technological framework reliability and suitability, as defined by the program's curriculum and industry standards.	conferences to enhance their expertise. 2. **Collaboration Platforms:** Create a centralized platform for faculty members to collaborate, share research findings, and discuss teaching methodologies. This can include regular meetings, an internal website, or a shared resource repository. 3. **Curriculum Review Committee:** Establish a committee of faculty members responsible for regularly reviewing and updating the curriculum to reflect industry needs and advancements. This committee can meet periodically to make necessary changes. 4. **Student Mentorship:** Encourage faculty to actively engage in mentorship programs for students, guiding them through their academic journey, assisting with research projects, and providing career advice. 5. **Research Grants:** Support faculty members in securing research		Here's a sample program timeline from both perspectives for the program "Enhancing Technological Framework Reliability for Improved Facility Availability and Strengthening Suitability": ***Faculty Perspective:*** 1. **Year 1: Program Launch and Development** ○ Develop the program curriculum and establish learning objectives. ○ Hire faculty members with expertise in technological framework reliability and suitability. ○ Set up faculty development programs and research initiatives. 2. **Year 2: Curriculum Refinement and Collaboration** ○ Review and refine the curriculum based on	faculty and students' perspectives: ***Faculty Perspective:*** 1. **Regular Faculty Meetings:** ○ Hold monthly or quarterly meetings to discuss program goals and objectives, curriculum updates, and research progress. ○ Faculty members share their research findings and challenges. 2. **Curriculum Review Committee:** ○ Establish a committee responsible for periodic curriculum reviews. ○ The committee should meet at least annually to assess the curriculum's alignment with industry trends and make recommendations for improvements. 3. **Research Output Metrics:** ○ Evaluate faculty research productivity by tracking the number of publications, presentations,	

Study's Modified Template for School Improvement Plan Anchored on DepEd Order No. 44 Series of 2015

Figure 5 shows the study's recommended inputs based on evaluating the various critical difficulties that faculty and students encountered in K–12 STEM ICT curricular offerings.

The study's output suggests a comprehensive approach that considers the unique perspectives of faculty and students in shaping the ICT Program. The proposed inputs aimed to create an inclusive and effective learning environment where both educators and learners actively contribute to the enhancement of ICT curricular offerings. Here's the link for a clear copy of the image: https://tinyurl.com/InputsFacultyStudents

Figure 6: Proposed ICT Curricular Offering Inputs for Grade 11- (Introduction to Python Programming

Source: DepEd Order No. 34, s. 2022 School Calendar of Activities S.Y 2022-2023 and the Most Essential Learning Competencies (MELCs)

PROPOSED ICT CURRICULAR OFFERINGS IN THE K – 12 STEM

Field of Study: Information and Communications Technology
Specialized Field: Computer Science
Specific Area of Study: Computer Programming

Grade Level: Grade 11
Course Duration: First Semester (1st and 2nd Quarters)
Course Title: Introduction to Python Programming

Course Description:
The "Introduction to Python Programming for STEM" course is designed to provide students in the field of Information and Communication Technology (ICT) within STEM disciplines with a strong foundation in programming using the Python language. Python is widely recognized for its simplicity, versatility, and applicability in scientific, engineering, and data-driven environments.

This course is tailored to equip students with the essential skills needed to develop, analyze, and solve real-world problems using Python. Throughout the course, students will explore fundamental programming concepts, Python syntax, data manipulation, and the application of Python in STEM-related projects. The curriculum places a strong emphasis on hands-on activities and problem-solving, enabling students to apply their newly acquired programming skills in practical STEM scenarios.

Course Goals:
The "Introduction to Python Programming for STEM" course aims to equip students with essential programming skills to excel in STEM fields, providing a solid foundation for further studies or careers in science, technology, engineering, and mathematics. Students will develop the ability to harness Python's power for problem-solving and data-driven decision-making in their STEM endeavors.

Course Objectives:
This course is designed for students in STEM fields, especially those pursuing careers or academic paths that require data analysis, simulation, scientific computing, or engineering. It is ideal for those who are new to programming and want to acquire foundational Python skills to enhance their STEM-related work.

By the end of the course, students will be able to:

1. **Understand Python Fundamentals:** Gain proficiency in Python programming, including variables, data types, control structures, functions, and object-oriented programming principles.
2. **Problem-Solving Skills:** Develop the ability to solve complex problems by applying Python programming techniques in STEM contexts.
3. **Data Analysis:** Learn to manipulate and analyze data using Python libraries, such as Pandas and Matplotlib, for data-driven decision-making in STEM fields.
4. **Practical Applications:** Apply Python to create practical STEM projects, such as simulations, data visualizations, and simple scientific experiments.
5. **Collaboration and Communication:** Work effectively in teams to develop and present Python-based projects, fostering collaborative and communication skills.

Study's Modified Template of DepEd Curriculum-MELCs

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Source: DepEd Order No. 34, s. 2022 School Calendar of Activities S.Y 2022-2023 and the Most Essential Learning Competencies (MELCs)

Course Syllabus:
This course introduces Grade 11 STEM students to Python programming, a versatile language widely used in scientific, engineering, and data analysis fields. The course covers the fundamentals of Python, data manipulation, problem-solving, and the application of Python in STEM-related projects.

This course syllabus provides a comprehensive plan for "Introduction to Python Programming" for Grade 11 STEM students. It covers a wide range of Python programming topics and practical applications in STEM, giving students a strong foundation for their future endeavors. Educators can adapt and expand upon it based on their students' needs and resources.

Content Standards:
By the end of this course, students will be able to:
- Demonstrate proficiency in Python programming, including variables, data structures, control structures, functions, and object-oriented programming.
- Apply Python programming to STEM projects, data analysis, and problem-solving.

Performance Standards:
By the end of this course, students will be able to:
- Write and execute Python programs to solve real-world problems.
- Debug, optimize, and document Python code effectively.
- Design and implement Python-based STEM projects and data analysis.

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	ACTIVITIES	WEEK NO.
First Semester (Quarter 1)					
Module 1: Introduction to Python • Overview of Python • Installing Python and IDEs • Writing and running Python programs • Python syntax and basic I/O	Students will be able to: • demonstrate an understanding of the fundamental concepts of Python programming. • install Python and an Integrated Development Environment (IDE). • write and execute Python programs.	Students will be able to: • write and execute Python programs to solve simple problems. • install Python and a Python IDE on their own. • explain the core concepts of Python programming.	Students will be able to: 1. explain the history and significance of Python in the programming world. 2. install Python and a preferred Python IDE (e.g., Anaconda, Visual Studio Code). 3. write Python programs to perform basic tasks and solve simple problems.	**1. Lecture: Overview of Python (1 hour)** ○ Introduction to Python's History and Significance ○ Discussion of Python's use cases in various industries **2. Practical: Installing Python and IDEs (1 hour)** ○ Step-by-step guide to installing Python on different platforms (Windows, macOS, and Linux) ○ Installation of a Python IDE (e.g., PyCharm, Jupyter Notebook)	2 Weeks

Study's Modified Template of DepEd Curriculum-MELCs

Figure 6 shows the study's proposed ICT curriculum offering inputs for the first semester of Grade 11 under K-12 STEM, specifically in the context of an "Introduction to Python Programming" course:

Synthesizing this information, the study's output reflects a comprehensive plan for introducing Python programming to Grade 11 students. The course highlights the contents, content standard, performance standard, learning competencies, pedagogical strategies, classroom activities, and practical applications incorporated into the curriculum, with an emphasis on preparing students for the demands of the digital age. Here's the link for a clear copy of the image: https://tinyurl.com/G11-ICT-IntroPythonProgramming

Figure 7: Proposed ICT Special Program Curricular Offering Inputs for Grade 11 (Robotics with Arduino)

Source: DepEd Order No. 34, s. 2022 School Calendar of Activities S.Y 2022-2023 and the Most Essential Learning Competencies (MELCs)

PROPOSED ICT SPECIAL PROGRAM CURRICULAR OFFERINGS IN THE K – 12 STEM

Field of Study: Information and Communications Technology
Specialized Field: Computer Science
Specific Area of Study: Robotics
Grade Level: Grade 11
Course Duration: First Semester (1st and 2nd Quarters)
Course Title: Robotics with Arduino

Course Description:
This comprehensive two-quarter-semester course is designed for Grade 11 students enrolled in the STEM special program with a focus on Information and Communications Technology (ICT). The course introduces students to the fascinating world of robotics, utilizing the versatile Arduino platform as the foundation for hands-on exploration and learning.

Quarter 1: Introduction to Robotics with Arduino

In the first quarter, students will embark on a journey into the fundamentals of robotics. Starting with an orientation to the field, participants will gain insights into the principles of electronics and circuit design. The course delves into programming essentials using the Arduino Integrated Development Environment (IDE), covering variables, data types, and control structures.

As students progress, they will explore a variety of sensors and actuators, mastering the art of interfacing these components with Arduino. Practical application takes center stage with the creation of a line-following robot, providing students with valuable experience in problem-solving, debugging, and teamwork.

Quarter 2: Advanced Robotics with Arduino

Building upon the foundational knowledge acquired in the first quarter, the second quarter delves into advanced programming concepts, including object-oriented programming and sophisticated algorithms. Students will explore the integration of computer vision, using cameras and image processing techniques to enable their robots to see and respond intelligently to their environment.

This quarter, students will also be introduced to the intersection of robotics and ICT through the integration of machine learning on the Arduino platform. The course covers the basics of machine learning, edge computing, and the implementation of simple models on Arduino.

The final hands-on project challenges students to design and construct an autonomous robot, showcasing their proficiency in combining all the concepts learned throughout the course. The course concludes with an exploration of the Internet of Things (IoT) and cloud integration, enabling students to connect their Arduino projects to the internet, paving the way for remote monitoring and control.

Study's Modified Template of DepEd Curriculum-MELCs

Source: DepEd Order No. 34, s. 2022 School Calendar of Activities S.Y 2022-2023 and the Most Essential Learning Competencies (MELCs)

- ○ To equip students with a strong foundation in robotics and ICT, providing them with the necessary skills to pursue further studies in technology-related fields.

10. **Presentation and Demonstration Skills:**
    - ○ To enhance students' presentation and demonstration skills by culminating the course with a final project presentation, where they showcase their creations and explain the technological concepts behind them.

Course Syllabus:
- This syllabus is designed to provide a comprehensive understanding of robotics, from basic principles to advanced applications in ICT, encouraging students to explore, create, and problem-solve in a hands-on learning environment.

Content Standards:
- Students will demonstrate an understanding of foundational robotics concepts, including electronics, Arduino programming, sensor integration, advanced programming principles, and the application of ICT-related techniques in robotics.

Performance Standards:
- By the end of the course, students should be able to design, build, and program a functioning autonomous robot using Arduino that integrates various sensors, actuators, and advanced programming concepts in the context of ICT applications

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	ACTIVITIES	WEEK NO.
First Semester (Quarter 1)					
Module 1: Orientation and Basics • Introduction to the world of robotics • Overview of Arduino and its components • Basic electronics and circuit design	Students will be able to: • demonstrate an understanding of foundational concepts in robotics, Arduino technology, basic electronics, and circuit design.	Students will be able to: • explain the fundamental principles of robotics, identify Arduino components, and apply basic electronics knowledge to design simple circuits.	Students will be able to: 1. **Understanding Robotics Fundamentals:** ○ define the core principles and applications of robotics. ○ differentiate between various types of robots and their functions.	1. **Introduction to Robotics:** ○ Presentation and discussion on the history, applications, and significance of robotics in various fields. ○ Showcasing videos or demonstrations of different types of robots to engage students. 2. **Arduino Overview and Components:** ○ Presentation and hands-on demonstration of an Arduino board, explaining its	1 Week

Study's Modified Template of DepEd Curriculum-MELCs

Figure 7 focuses on the proposed ICT Special Program curriculum offering inputs for the first semester of Grade 11, specifically in the context of a "Robotics: Python with Arduino" course.

Synthesizing this information, the study's output reflects a specialized and hands-on approach to ICT education, offering students a unique opportunity to explore the intersection of Python programming and Arduino in the

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exciting field of robotics. The course highlights the practical applications, technical skill development, and potential career pathways associated with the specialized program. Here's the link for a clear copy of the image: https://tinyurl.com/G11-ICT-PythonwithArduino

Figure 8: Proposed ICT Curricular Offering Inputs for Grade 12-(Advanced Python Programming)

Source: DepEd Order No. 34, s. 2022 School Calendar of Activities S.Y 2022-2023 and the Most Essential Learning Competencies (MELCs)

PROPOSED ICT CURRICULAR OFFERINGS IN THE K – 12 STEM

Field of Study: Information and Communications Technology
Specialized Field: Computer Science
Specific Area of Study: Computer Programming

Grade Level: Grade 12
Course Duration: Second Semester (3rd and 4th Quarters)
Course Title: Advanced Python Programming

Course Description:
The "Advanced Python Programming for STEM" course is designed for students in the field of Information and Communication Technology (ICT) within STEM disciplines. Building upon the foundational knowledge of Python programming, this course delves into advanced concepts and practical applications, preparing students for complex problem-solving and real-world challenges.

Python is a versatile and widely used programming language, particularly relevant in scientific, engineering, data analysis, and web development contexts. This course equips students with the skills and expertise required to harness the full potential of Python in advanced ICT applications.

This course is tailored to equip students with the essential skills needed to develop, analyze, and solve real-world problems using Python. Throughout the course, students will explore fundamental programming concepts, Python syntax, data manipulation, and the application of Python in STEM-related projects. The curriculum places a strong emphasis on hands-on activities and problem-solving, enabling students to apply their newly acquired programming skills in practical STEM scenarios.

Course Goals:
The "Advanced Python Programming for STEM" course is designed to equip students with advanced programming skills and expertise in using Python for specialized STEM applications. Successful completion of this course will prepare students for more complex STEM projects, data-driven decision-making, and advanced studies or careers in ICT and STEM-related fields.

Course Objectives:
This course is designed for students in STEM fields, especially those seeking to specialize in ICT and related disciplines. It is ideal for individuals who want to excel in data analysis, machine learning, web development, and advanced scientific computing using Python.

By the end of the course, students will be able to:

1. **Advanced Python Proficiency:** Demonstrate advanced proficiency in Python programming, including data manipulation, scientific computing, machine learning, and web development.
2. **Complex Problem-Solving:** Develop the ability to solve complex problems by applying Python programming techniques in STEM contexts and beyond.
3. **Specialized Application Skills:** Acquire expertise in data science, machine learning, web development, and advanced scientific computing using Python.

Study's Modified Template of DepEd Curriculum-MELCs

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4. **Practical STEM Projects:** Create and implement complex Python-based STEM projects, simulating real-world scenarios and demonstrating creativity and innovation.
5. **Collaboration and Communication:** Collaborate effectively with peers, present and explain complex Python projects, and document findings for professional communication.

Course Syllabus:
This course is designed to build upon the foundational Python programming skills learned in previous courses and take Grade 12 STEM students to an advanced level. The course covers topics such as data science, machine learning, web development, and more, with a strong emphasis on practical applications in STEM-related projects.

This course syllabus provides a comprehensive plan for "Advanced Python Programming" for Grade 12 STEM students. It covers a wide range of advanced Python programming topics and practical applications in STEM fields, preparing students for more advanced studies or careers in STEM-related disciplines. Educators can adapt and expand upon it based on their students' needs and resources.

Content Standards:
By the end of this course, students will be able to:
- demonstrate advanced proficiency in Python programming, including data manipulation, machine learning, web development, and scientific computing.
- apply Python to STEM projects, data analysis, machine learning, and web applications.

Performance Standards:
By the end of this course, students will be able to:
- write and execute advanced Python programs for complex problem-solving.
- apply advanced Python libraries and frameworks effectively.
- design and implement Python-based STEM projects with advanced features.

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	ACTIVITIES	WEEK NO.
Second Semester (Quarter 3)					
Module 1: Advanced Data Structures • Complex data structures (e.g., sets, queues, stacks) • Collections module and data manipulation	Students will be able to: • demonstrate an understanding of advanced data structures, including sets, queues, and stacks.	Students will be able to: • utilize advanced data structures such as sets, queues, and stacks for specific use cases.	Students will be able to: 1. describe the characteristics and use cases of complex data structures like sets, queues, and stacks.	1. **Lecture: Introduction to Advanced Data Structures (1 hour)** ○ Overview of advanced data structures, including sets, queues, and stacks	2 Weeks

Study's Modified Template of DepEd Curriculum-MELCs

Figure 8 presents the proposed curriculum inputs for Grade 12 in the field of Information and Communications Technology (ICT), focusing specifically on Advanced Python Programming. It offers a structured overview and serves as a visual guide to the proposed ICT curriculum for the second semester of Grade 12, focusing on Advanced Python Programming, in the context of the study of the proposed ICT curriculum. Through a comprehensive analysis of the figure, educators and stakeholders can ensure that the curriculum aligns with educational goals and industry demands and provides students with the skills necessary for success in the field of ICT. Here's the link for a clear copy of the image: https://tinyurl.com/G12-ICT-AdvPythonProgramming

Figure 9: Proposed ICT Special Program Curricular Offering Inputs for Grade 12 (Mechatronics for STEM)

Source: DepEd Order No. 34, s. 2022 School Calendar of Activities S.Y 2022-2023 and the Most Essential Learning Competencies (MELCs)

PROPOSED ICT SPECIAL PROGRAM CURRICULAR OFFERINGS IN THE K – 12 STEM

Field of Study: Information and Communications Technology
Specialized Field: Computer Science
Specific Area of Study: Machine Learning

Grade Level: Grade 12
Course Duration: First Semester (3rd and 4th Quarters)
Course Title: Mechatronics for STEM

Course Description:
The Mechatronics course for Grade 12 STEM students is an exploration of the fundamental principles and advanced concepts in mechanical and electrical engineering, computer programming, and control systems. Students will delve into the fusion of mechanical and electrical components, exploring their interactions and applications in modern technologies.

Mechatronics, an interdisciplinary field at the nexus of mechanical engineering, electronics, computer science, and control systems, explores the integration of these diverse disciplines to create intelligent and adaptable systems. This course is designed to provide students with a comprehensive understanding of mechatronic systems and their practical applications in various industries.

The Introduction and Advanced Mechatronics course for Grade 12 STEM students is a two-part exploration of the foundational principles and advanced concepts in mechatronics—a multidisciplinary field encompassing mechanical and electrical engineering, computer science, and control systems. The course aims to provide students with a comprehensive understanding of mechatronic systems and their practical applications in modern industries.

Quarter 3: Introduction to Mechatronics

The Introduction to Mechatronics segment is designed to acquaint students with the fundamental principles of mechanical and electrical engineering, providing a solid foundation in sensors, actuators, control systems, and basic programming for mechatronic applications.

By the end of the Introduction segment, students will be able to understand the fundamental components of mechatronic systems, demonstrating basic proficiency in integrating mechanical and electrical principles.

Quarter 4: Advanced Mechatronics

The Advanced Mechatronics segment delves deeper into the intricacies of mechatronic systems, focusing on complex control systems, advanced programming for embedded systems, and the integration of cloud computing and IoT in mechatronics.

Study's Modified Template of DepEd Curriculum-MELCs

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Source: DepEd Order No. 34, s. 2022 School Calendar of Activities S.Y 2022-2023 and the Most Essential Learning Competencies (MELCs)

Performance Standards:
These performance standards ensure that students not only understand and apply the foundational and advanced concepts in mechatronics but also develop crucial problem-solving and communication skills, leading to the successful execution of complex mechatronic projects.

Introduction to Mechatronics:

1. **Conceptual Understanding:** Students will demonstrate a comprehensive understanding of foundational mechatronic principles through accurate problem-solving and theoretical explanations.
2. **Practical Application:** Students will successfully apply basic mechanical, electrical, and control system concepts to assemble and program basic mechatronic systems.
3. **Effective Communication:** Students will effectively communicate and articulate basic mechatronic concepts both verbally and in written form.
4. **Critical Thinking and Problem-Solving:** Students will demonstrate critical thinking abilities by effectively solving problems related to basic mechatronics principles and applications.

Advanced Mechatronics:

1. **Advanced Application:** Students will exhibit proficiency in applying advanced control algorithms, programming embedded systems, and integrating IoT in complex mechatronic applications.
2. **Innovation and Design:** Students will showcase their ability to innovate, design, and execute advanced mechatronic projects integrating various sophisticated concepts.
3. **Project Management and Presentation:** Students will effectively manage the capstone project, presenting well-structured plans and executing projects, demonstrating an in-depth understanding of advanced mechatronics.

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	ACTIVITIES	WEEK NO.
Second Semester (Quarter 3)					
Module 1: Fundamentals of Engineering • Introduction to Engineering Principles	Students will be able to: 1. **Understanding Engineering Principles** ○ comprehend foundational principles	Students will be able to: 1. **Mastery of Core Engineering Principles** ○ demonstrated understanding of key	Students will be able to: 1. **Theoretical Understanding** ○ understanding fundamental theories and principles in engineering	1. **Interactive lectures and discussions** ○ Introduction to Engineering Principles through lectures and engaging discussions ○ Class debates on the application of	2 Weeks

Study's Modified Template of DepEd Curriculum-MELCs

Figure 9 shows the proposed curriculum inputs for the second semester of Grade 12, specifically tailored for a special program within Information and Communication Technology (ICT). The specialization is focused on the intersection of Machine Learning and Mechatronics. This encompasses a range of topics, from foundational machine learning algorithms and principles to mechatronic system design and implementation. The specialization's dual nature fosters an interdisciplinary approach, as discussed in the study's output. This involved collaboration between computer science and engineering faculties, encouraging students to apply knowledge from both fields. Here's the link for a clear copy of the image: https://tinyurl.com/G12-ICT-MachLearnMechatronics

Bonifacio (2013) examines the Philippine K–12 ICT curriculum norms and ICT integration in education, especially in poor nations. Literature highlights include:

Teachers in developing countries like the Philippines worry about ICT integration. Technology is crucial, but research believes education should stress larger purposes. Set academic goals before ICT. Philippine K–12 ICT integration should improve student growth. Stressing important traits may help Filipino kids understand ICT, research shows.

Leadership affects ICT integration. Research shows that great leadership motivates, innovates, and sustains ICT programs. Strategy, stakeholder persuasion, and cooperation are needed to defeat widespread opposition to change.

Instructor attitudes, skills, and classroom uptake affect ICT integration. Educational, administrative, and governmental entities must develop ICT courses. Filipinos value technology's economic and national benefits. Therefore, academics recommend ICT in Philippine K–12 education. For appropriateness, efficacy, and sustainability, academics recommend knowing standards, planning for problems, and sustaining classroom ICT integration.

This study explores how leadership, teacher attitudes, and education goals affect Philippine ICT integration. ICT integration into education requires strategic planning, collaboration, and persistence, according to research.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This section pertains to the summary of findings wherein the results were statistically treated, analyzed, and interpreted as the basis for it discussion to reach reasonable conclusions and come up with justifiable recommendations.

Summary of Findings

The main objective of this study was to design the educational curricular offerings in Information and Communications Technology (ICT) for K-12 STEM education. Subsequently, these modified courses would serve as the basis for formulating a plan for an Information and Communication Technology (ICT) program.

The study aims to examine significant findings that suggest the possibility of improvement by reevaluating ICT program offerings in K-12 STEM education. The research reveals useful insights and recommendations, providing a clear framework for program planners, educators, and policymakers who aim to utilize ICT to improve STEM teaching in basic education. The study's findings were presented in a manner that appropriately addressed the researcher's specific questions.

The Competencies Least Mastered by the Learners Based on the Most Essential Learning Competencies (MELCs)

In an evaluation of knowledge and skills conducted to the learners on ICT program offerings in the K – 12 STEM namely Media Information Literacy (MIL) and Empowerment Technology (EMPTECH) the researcher came up with a list of identified least mastered competencies based on Most Essential Learning Competencies (MELCs).

The findings of a knowledge evaluation on ICT subjects in the Most Essential Learning Competencies (MELCs) within the domain of Media and Information Literacy (MIL) are displayed for a total of 212 students. The three questions with the fewest number of accurate answers are:

1. "What is the potential impact of media consumption on an individual's understanding of the world?" is included under the topic (Introduction to Media and Information Literacy) under the learning competency *[The learner would be able to describe how communication is affected by media and information...].* The percentage of students was 9%, which corresponds to a total of 19 learners.

2. *"Which of the following is an example of a biased or unreliable source of audio information and media?"* is included under the topic of (Audio Information and Media) under the learning competency *[The learner would be able to evaluate the reliability and validity of audio information and media and their sources using selection criteria...].* The percentage of students was 30%, which is equivalent to 63 learners.

3. *"What potential impacts might the use of big data have on the media industry?"* is included under the topic (Current and Future Trends of Media and Information) under the learning competency *[The learners would be able to evaluate current trends in media and information and how they will affect individuals and society as a whole].* The percentage of students is 33%, which corresponds to a total of 69 learners.

Conversely, the outcome emphasizes the evaluation of ICT skills in the MELCs curriculum for the same group of 212 learners under MIL. The three questions with the lowest accuracy rates are:

1. "In the current new media society, how can the media play a role in promoting civic engagement and participation in a democratic society?" is included under the topic (The Evolution of Traditional to New Media) under the learning competency *[The learner would be able to editorialize the roles and functions of media in a democratic society...].* The percentage of students is 3%, which corresponds to a total of 7 learners.

2. *"What is the purpose of using motion graphics software to create motion media?"* is included under the topic (Motion Information and Media) under the learning competency *[The learner would be able to produce and evaluate a creative motion-based presentation using design principles and elements].* A total of 138 learners, which accounts for 65% of the total, fall into this category.

3. *"Which of the following is an example of intellectual property infringement?"* is included under the topic (Legal, Ethical, and Societal Issues in Media and Information) under the learning competency *[The learner would be able to put into practice their understanding of intellectual property, copyright, and fair use of guidelines].* The percentage of students is 68%, which corresponds to a total of 144 learners.

The results of assessments related to ICT knowledge under the Most Essential Learning Competencies (MELCs) for Empowerment Technology (EMPTECH) for a total of 324 students are presented. The three questions with the lowest percentage of correct answers are:

1. "Which of the following is not a reason why analyzing the expected response of target or intended users is important for an ICT project for social change?" is included under the topic (Developing an ICT Project for

Social Change) under the learning competency *[Analyze how target or intended users and audiences are expected to respond to the proposed ICT Project for Social Change on the basis of content, value, and user experience].* The percentage of students was 25.93%, which corresponds to a total of 84 learners.

2. "Why is it important to choose a cause or issue that is relevant to your community?" is included under the topic (Cultural Heritage Promotion Through New Designs, "Pinoy Pride") under the learning competency *[Identify a local or regional cause or issue for social change related to specific professional tracks that can be addressed or tackled using an ICT project for social change].* The percentage of students was 31.79%, which corresponds to a total of 103 learners.

3. "What is the purpose of distributing and presenting current or previously created content via a newsletter or blog site?" is included under the topic (Collaborative Development of ICT Content) under the learning competency *[Share and showcase existing or previously developed material in the form of a collaboratively designed newsletter or blog site intended for a specific audience or viewer].* The percentage of students was 32.41%, which corresponds to a total of 105 learners.

Conversely, it focuses on the skills assessment of the same ICT topics within EMPTECH for the same 324 students. The top three questions with the lowest percentage of correct answers are:

1. "How can the success of an ICT project for social change be measured?" is included under the topic (Developing an ICT Project for Social Change) under the learning competency *[Analyze how target or intended users and audiences are expected to respond to the proposed ICT project for social change on the basis of content, value, and user experience].* The percentage of students was 56.79%, which corresponds to a total of 184 learners.

2. "How can ICT projects for social change be scaled up or replicated in other communities?" is included under the topic (Cultural Heritage Promotion Through New Designs, "Pinoy Pride") under the learning competency *[Identify a local or regional cause or issue for social change related to specific professional tracks that can be addressed or tackled using an ICT project for social change].* The percentage of students was 62.04%, which corresponds to a total of 201 learners.

3. "How can typography be used to effectively communicate a message in web design?" is included under the topic (Applying Principles and Techniques of Design Using Online Platforms) under the learning competency *[Apply web design principles and elements using online creation tools, platforms, and applications to communicate a message for a specific purpose in specific professional tracks]*. The percentage of students was 66.67%, which corresponds to a total of 216 learners.

The Performance of the Students in EMPTECH and MIL Based on their General Weighted Average (GWA) in ICT

The provided interpretation and analyses based on students' performance summarize the results of the school's effectiveness in imparting knowledge and skills in two subjects: MIL (Media and Information Literacy) and EMPTECH (Empowerment Technology). The assessment of effectiveness is based on grading systems and remarks, where "Passed" indicates effectiveness and "Failed" indicates ineffectiveness.

1. MIL (Media and Information Literacy, GWA):

All students received a "Passed" remark. There is one student with a GWA between 80 and 84, 100 students with a GWA between 85 and 89, and 111 students with a GWA between 90 and 100. This indicates that the school is effective in imparting ICT knowledge and skills to its students.

2. EMPTECH (Empowerment Technology, GWA):

All students achieved a "Passed" status. There are 10 students with a GWA between 80 and 84, 99 students with a GWA between 85 and 89, and 215 students with a GWA between 90 and 100. This indicates that the institution successfully imparts information and skills in EMPTECH to its learners.

In summary, the school appears to be effective in both MIL and EMPTECH, as indicated by high "Passed" rates in students' GWA.

The Relationship Between the Students' Performance in ICT Knowledge and Skills Evaluation and their GWA in Relations to the Schools' Level of Effectiveness

The provided interpretation and analyses were based on a relationship test between students' performance, which summarizes the results of the school's effectiveness in imparting knowledge and skills in two subjects: MIL (Media and Information Literacy) and EMPTECH (Empowerment Technology). The researcher used Rho, Spearman's Rank-Order Correlation Coefficient, which is used to examine variable correlations in the study. This helped the study describe the relationship between the students' performance in knowledge and skills evaluation under GWA in ICT to the schools' level of effectiveness.

1. Knowledge and Skills in Media and Information Literacy (MIL) and GWA:

There is a statistically significant positive association between the evaluation of Knowledge and Skills in MIL and the General Weighted Average (GWA). The correlation coefficient is 0.317, indicating a positive relationship. This suggests that as the evaluation scores for MIL improve, the GWA tends to increase.

2. Knowledge and Skills in Empowerment Technology (EMPTECH) and GWA:

There is a statistically significant positive association between the evaluation of Knowledge and Skills in EMPTECH and the GWA. The correlation coefficient is 0.271, suggesting a positive relationship. This indicates that as the evaluation scores for EMPTECH improve, the GWA is likely to increase.

The Issues and Challenges Experienced by the Respondents in ICT Curricular Offerings in the K – 12 STEM

The provided interpretation and analyses were based on the evaluation of issues and challenges experienced by the respondents with the ICT curricular offerings in K–12 STEM, which summarizes the perceived thoughts of the respondents.

1. Evaluation of ICT Curricular Offerings in K-12 STEM with Regards to the Level of Competency of the Faculty

- Students and faculty both expressed agreement with the claims. Administrators and experts strongly supported the evaluation. Administrator's highest mean (4.00) for "Faculty's competency in attitude towards ICT" and Faculty's lowest mean (3.12) for "Faculty expertise"

2. Evaluation of ICT Curricular Offerings in K-12 STEM with Regards to the Level of Reliability of the Technological Framework

- Participants expressed agreement with the assessment of ICT curriculum offerings. Administrators had the highest average score (3.48) for "Reliability of the technological framework in ICT resource accessibility." Faculty had the lowest average score (2.95) for "Reliability of the technological framework in facility availability."

3. Evaluation of ICT Curricular Offerings in K-12 STEM with Regards to the Level of Learning Satisfaction of Students

- Participants expressed agreement with the overall evaluation. Experts had the highest average score (3.44) for "Student's perceived relevance of acquired ICT skills." Faculty had the lowest average score (2.82) for "Consistency of teacher support in learning ICT."

4. Evaluation of ICT Curricular Offerings in K-12 STEM with Regards to the Level of Relevance Appropriate to the STEM Environment

- Administrators and experts expressed a high degree of agreement. Students and faculty expressed a moderate level of agreement. Administrators had the highest mean score (3.71) for "Appropriateness of ICT integration." Students had the lowest mean score (3.26) for "Accuracy of learning assessments in ICT."

5. Evaluation of ICT Curricular Offerings in K-12 STEM with Regards to the Level of Acceptability of the Organizational Culture Towards Maximizing ICT

- Administrators and experts expressed a high level of agreement. Students and faculty expressed a moderate level of agreement. Administrators had the highest average score (3.7) for "Organizational culture's acceptance of beliefs and ideologies." Students had the lowest average score (3.07) for "Organizational culture in relation to policy effectiveness in achieving goals."

In summary, the results indicate generally positive perceptions of the ICT curriculum offerings in K–12 STEM, with some variations in the evaluation of faculty competency, technological framework, student satisfaction, suitability for the STEM environment, and organizational culture. Administrators and experts tend to have higher levels of agreement than students and faculty in most cases.

The Significant Difference Between the Issues in ICT Curricular Offerings in K – 12 STEM as Perceived by the Respondents

Responses to issues experienced in K-12 STEM ICT courses differ. Results reveal that Students, Experts, Administrators, and Faculty see K-12 STEM ICT courses differently. An α value of 0.019, below the 0.05 significance level, indicates significant differences. In light of these significant variances, a one-size-fits-all ICT curriculum creation technique may not work. Designers and educators should adapt their methods to stakeholder preferences.

Targeted Improvement: Fill ICT curricular gaps. From these areas, group issues or strengths can be addressed. Due to inconsistencies, program design and execution must include constant evaluation and feedback. ICT courses can be tailored to K-12 STEM education using student, specialist, administrator, and teacher feedback.

The study shows that respondents have different viewpoints on K-12 STEM ICT curricula, requiring attention. By recognizing and addressing these differences, educators and program planners can create a more inclusive, effective, and flexible ICT curriculum that meets K-12 STEM education stakeholders' demands.

The Program Plan in ICT Developed Based on the Results of the Study

The study's findings suggest that in order to create a framework for ICT program planning, it is essential to develop two separate proposals for the suggested inputs. The research examined challenges in K–12 STEM and ICT curricular offerings and found that curriculum experts and school administrators had similar perspectives, as did faculty members and students. The researcher has proposed two distinct recommendations to address the specific challenges faced by these groups, facilitating their ability to address future issues.

The recommended inputs for the ICT program planning framework include various elements such as identified issues, categorized components, program inputs, goals and objectives, program outcomes, implementation strategies, involved individuals, duration, monitoring and evaluation, and the source of funds. These findings aimed to guide the development of effective ICT programs in K–12 STEM education.

Conclusions

Based on the above summary of findings, the following conclusions were drawn from the study:

1. Based on the study, students have specific skills and knowledge gaps in essential MIL and EMPTECH curricula. To overcome these difficulties, educators and curriculum designers must update the curriculum, improve teaching techniques, and provide additional resources and support to help students understand

ICT education's core principles and skills. This can improve learning and prepare learners for the real-life technology experience.

2. Based on the study, student GWAs show MIL and EMPTECH are taught well. Although some students failed the knowledge and skills evaluation, the school's EMPTECH learning showed a high success rate. High "Passed" rates in subjects and GWA distribution demonstrate the school's teaching and assessment skills. This shows the school's academic strength in ICT. MIL and EMPTECH knowledge and skills evaluations had a positive connection with GWA. These results suggest that assessments of individual knowledge and skills in these disciplines can fully explain school effectiveness.

3. The study revealed a positive correlation between MIL and EMPTECH performance in knowledge and skills evaluation and GWA. Performance in MIL and EMPTECH was significantly associated with higher GWAs. These findings indicate that assessments of individual knowledge and skills in these fields may completely reflect the factors that affect school-level effectiveness.

4. The study found that there were generally positive responses about the ICT curriculum offerings in K–12 STEM. However, there are differences in the level of acceptance across different groups of participants. Administrators and specialists generally exhibit greater agreement, whereas students and teachers showed moderate levels of agreement, suggesting potential areas for improvement and enhancement in the ICT curriculum and related factors.

In addition, the study revealed significant differences in how students, experts, administrators, and faculty view K–12 STEM ICT courses. These differences were statistically significant, indicating that a one-size-fits-all approach to ICT curriculum creation may not be suitable. Based on the findings, K–12 STEM ICT curricula should take into account the different perspectives of students, experts, administrators, and teachers. By doing so, educators and program planners can modify and improve the curriculum to each group's needs and preferences, ensuring education is more adaptive, effective and inclusive.

5. This study proved the importance of tailoring ICT program planning to the unique perspectives and challenges faced by different stakeholders in K–12 STEM education. The research revealed that curriculum experts and school administrators share similar viewpoints, as do faculty members and students, when it comes to the issues surrounding ICT curricular offerings.

Recommendations

Based on the above summary of findings and conclusions drawn in the study, the following matters were recommended.

1. The researcher proposes reevaluating K–12 STEM ICT program curriculum in the National Capital Region and nationwide. To fill knowledge and ability shortfalls, update the MIL and EMPTECH courses. Make sure the curriculum follows ICT industry trends and best practices.

2. Review the K-12 STEM curriculum and incorporate STEM principles into other areas to promote cross-disciplinary knowledge. This method can help students adjust to digital expectations and use ICT in varied circumstances. Real-world case studies and practical applications make the program more interesting and industry-relevant.

3. Provide additional training and resources for educators to improve their teaching techniques in these disciplines. This could involve workshops, online courses, or mentorship programs to enhance their ability to impart core ICT principles effectively.

4. Reevaluate MIL and EMPTECH school assessments to ensure they appropriately reflect student knowledge and skills. Consider a holistic approach that includes individual and school-level assessment. This may require different assessment tools or ongoing evaluation.

5. Provide students internet tutorials, reference materials, and instructional websites. These tools can help students understand complicated concepts and keep up with ICT innovations.

6. To serve various groups, K–12 STEM ICT course designers and teachers must provide frequent feedback. Stakeholders enable constant improvement. Get regular ICT curriculum feedback from students, instructors, administrators, and experts. Apply feedback to improve. Course designers and instructors must use continuous assessment and feedback to ensure K–12 STEM ICT course mastery.

7. Collaborate and recognize that students, experts, administrators, and teachers have different views on K–12 STEM ICT courses. Develop flexible, adaptable programs to meet these groups' different needs and interests.

8. Consider creating specialized tracks within the ICT curriculum to cater to specific interests or career goals. For example, offer options for students who want to focus on programming, robotics, mechatronics, digital media, or cybersecurity.

9. Encourage research and innovation within the field of ICT education. Stay informed about the latest trends and best practices to continually improve program offerings.

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