ISSN: 2584-0231(Online)
International Journal of Multidisciplinary Research in Arts, Science and Technology
Volume 4 | Issue 10 | October 2026
Available online at: https://ijmrast.com
DOI: https://doi.org/10.59828/ijmrast.v4i10.326

TECHNOLOGICAL SKILLS AND TECHNOLOGY INTEGRATION IN SCIENCE AMONG SENIOR HIGH SCHOOL STUDENTS

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Abstract

The integration of technology in science education provides learners with opportunities to access information, collaborate, solve problems, and engage in meaningful learning experiences. However, effective technology integration depends not only on the availability of digital resources but also on learners' technological skills and their ability to use technology appropriately and purposefully. This study determined the level of technological skills and the extent of technology integration in science learning among Grade 11 and Grade 12 learners enrolled in the Late Afternoon Senior High School (LASH) Program of Carlos P. Garcia Senior High School. It also examined differences in technological skills and technology integration when learners were grouped according to selected demographic characteristics and determined the relationship between the two variables. Using a quantitative descriptive-correlational research design, the study involved 150 learners from the LASH Program. Data were gathered through an adapted survey questionnaire measuring technological skills and technology integration in science learning and were analyzed using appropriate descriptive and inferential statistical tools. The findings showed that learners demonstrated a high level of technological skills, while technology integration in science learning was evident to a considerable extent. No significant differences were found in technological skills and technology integration when learners were grouped according to their demographic characteristics. However, a significant positive relationship existed between technological skills and technology integration, indicating that learners with stronger technological skills tended to integrate technology more effectively in their science learning. Based on these findings, a Technology Integration Plan for Science Learning was proposed to further develop learners' technological competencies and promote purposeful technology use in science education.

Keywords: *Digital Literacy, LASH Program, Science Learning, Technology Integration, Technological Skills.*

INTRODUCTION

The integration of technology in education has become increasingly important in improving the teaching and learning process, particularly in science education. Digital tools such as simulations, multimedia resources, and online platforms promote interactive learning, student engagement, and better academic performance (Garcia & Villanueva, 2021; Chen et al., 2021).

In the Philippines, the Department of Education (DepEd, 2022) has emphasized the use of educational technologies to improve learning outcomes. The growing accessibility of smartphones and online platforms has provided learners with opportunities for self-directed and collaborative learning. However, challenges such as limited resources, unequal access, and varying levels of digital literacy remain (UNICEF, 2021; Torres, 2021).

Despite these developments, not all students maximize technology for academic purposes. Some learners use digital devices primarily for non-educational activities, highlighting the need to examine how technology is integrated into their learning practices (Morales & De Guzman, 2020).

In the local context, limited evidence exists on how senior high school students in public schools utilize technology in science learning, particularly working students and lactating mothers enrolled in blended learning arrangements.

Therefore, this study aimed to determine the extent of technology integration in science learning through Google Forms for quizzes and assignments and Google Meet among Grade 11 and 12 students of Carlos P. Garcia Senior High School under the Late Afternoon Senior High (LASH) program. It also examined the relationship between technology integration and academic performance to provide insights that could help improve technology-supported science instruction.

Theoretical Framework

This study was anchored on Constructivist Learning Theory, advanced by Piaget and Vygotsky, and the Technological Pedagogical Content Knowledge (TPACK) Framework developed by Mishra and Koehler (2006), as cited by Putri et al. (2022) and Stinken-Rösner et al. (2022). Constructivist Learning Theory views learning as an active process in which students develop understanding through prior knowledge, experiences, social interactions, and engagement with their environment. In science education, this emphasizes exploration, collaboration, problem-solving, and meaningful learning. Similarly, the TPACK Framework highlights the importance of integrating technology, pedagogy, and content knowledge to make technology use purposeful and effective in learning.

In this study, Constructivist Learning Theory explained how students actively developed scientific understanding through digital resources and collaborative activities, while TPACK provided a basis for understanding how technology supported their science learning. Together, these theories guided the examination of students' technology integration and its possible relationship with their academic performance.

Statement of the Problem

The study generally aimed to determine the level of technological skills and the extent of technology integration in science learning among Senior High School students and to examine whether a significant relationship existed between these two variables at Carlos P. Garcia Senior High School under the Late Afternoon Senior High School (LASH) program.

Specifically, it sought to answer the following questions:

1.What is the demographic profile of the respondents in terms of: age; sex; civil status; Grade Level; and, employment status?

1. What is the level of technological skills of the respondents in terms of:
   - 1.1 operational and technical skills;
   - 1.2 information and digital literacy skills;
   - 1.3 communication and collaboration skills; and,
   - 1.4 problem-solving and digital productivity skills?
2. What is the extent of technology integration in science learning in terms of:
   - 2.1 personal learning practices
   - 2.2 instructional support; and,
   - 2.3 collaborative learning?
3. Is there a significant difference in the level of technological skills of the respondents when grouped according to their demographic profile?
4. Is there a significant difference in the extent of technology integration in science learning when grouped according to their demographic profile?
5. Is there a significant relationship between the respondents' level of technological skills and the extent of technology integration in science learning?
6. Based on the findings of the study, what output may be developed?

Hypotheses

The following hypotheses were utilized in the study:

There is no significant difference in the level of technological skills of the respondents when grouped according to their demographic profile.

There is no significant difference in the extent of technology integration in science learning when grouped according to their demographic profile.

There is no significant relationship between the respondents' level of technological skills and the extent of technology integration in science learning.

Scope and Delimitation of the Study

This study examined the integration of technology in science learning and its relationship with the academic performance of Grade 11 and 12 students enrolled in the Late Afternoon Senior High (LASH) program at Carlos P. Garcia Senior High School during School Year 2025–2026. Specifically, it focused on the technological tools and resources used, students' level of technological skills, and the extent of technology integration in their learning practices. Using a quantitative descriptive-correlational design, data were gathered through survey questionnaires, while academic performance was measured through students' official science grades. The study was limited to LASH students, excluding other grade levels, schools, and stakeholders, and relied on self-reported responses to assess technological skills and practices.

Definition of Terms

Collaborative Learning. This refers to the use of digital technologies by students to communicate, share information, and work with peers on science-related activities, assignments, and projects.

Instructional Support. This refers to the use of technology to complement classroom instruction in science through digital learning materials, multimedia presentations, virtual laboratories, online platforms, and other technology-assisted learning resources.

L.A.S.H. (Late Afternoon Senior High School). This refers to a special Senior High School program for learners who are employed, nursing mothers, or have other daytime responsibilities that prevent them from attending regular daytime classes. Classes are conducted in the late afternoon to provide flexible learning opportunities while enabling learners to complete their Senior High School education. In this study, L.A.S.H. learners are the respondents whose access to technology, technological skills, and level of technology integration in science learning are being examined.

Level of Technology Integration. This refers to the extent to which Grade 11 and 12 students incorporate technology into their science learning. In this study, it is measured in terms of personal learning practices, instructional support, and collaborative learning.

Personal Learning Practices. This refers to the independent use of technology by students for science learning, including conducting research, reviewing lessons, completing assignments, and accessing digital educational resources.

Science Learning. This refers to the processes through which students acquire scientific knowledge, skills, and competencies through classroom instruction, laboratory activities, assignments, and technology-supported learning experiences.

Technological Resources and Tools. These refer to the digital devices, applications, software, online platforms, and other technological resources used by students to facilitate science learning. Examples include smartphones, computers, tablets, educational applications, simulations, and learning management systems.

Technological Skills. This refers to the students' ability to effectively operate, navigate, evaluate, and utilize digital technologies for learning science. In this study, technological skills are assessed based on operational and technical skills, information and digital literacy skills, communication and collaboration skills, and problem-solving and digital productivity skills.

Technology Integration. This refers to the purposeful use of digital technologies, platforms, and resources by students to enhance learning in science. It involves applying technology to access information, complete academic tasks, participate in classroom activities, and collaborate with peers to improve the learning process.

Technology Integration Enhancement Plan. This refers to the proposed output of the study, which is designed based on the findings to strengthen students' technological skills and improve the integration of technology into science learning.

METHODS AND MATERIAL

Research Design

This study employed a descriptive-correlational research design to determine the level of technological skills and the extent of technology integration in science learning among Grade 11 and 12 students in the Late Afternoon Senior High

(LASH) Program of Carlos P. Garcia Senior High School. The descriptive component presented the students' existing technological skills and technology integration practices, while the correlational component examined whether a significant relationship existed between the two variables. According to Parker (2023), descriptive research describes existing conditions, while correlational research determines the association between variables without manipulation. This design was appropriate since the study examined the students' actual experiences and practices without introducing any intervention or experimental treatment.

Population and Sampling Technique

The study involved 243 Grade 11 and 12 learners enrolled in the Late Afternoon Senior High (LASH) Program of Carlos P. Garcia Senior High School during School Year 2025–2026. Using stratified random sampling, 150 respondents were selected from the different sections to ensure proper representation of the target population. The sample size was determined using the Raosoft Sample Size Calculator, with a 95% confidence level, a 5% margin of error, and an additional 20% allowance for possible non-responses. This sampling procedure ensured adequate representation of the learners and provided sufficient data to examine their technological skills, technology integration practices, and the relationship between the two variables.

Respondents of the Study

The respondents consisted of 150 selected Grade 11 and 12 learners from the 243 officially enrolled students in the Late Afternoon Senior High (LASH) Program of Carlos P. Garcia Senior High School during School Year 2025–2026. The sample size was determined using the Raosoft Sample Size Calculator, with a 95% confidence level and a 5% margin of error. These respondents were selected from the target population to provide relevant data on their technological skills, technology integration in science learning, and the relationship between these variables.

Instrumentation

The study utilized an adapted survey questionnaire as the primary data-gathering instrument, consisting of three parts: (1) Respondents' Profile, which gathered demographic information such as age, sex, section, civil status, and employment status; (2) Level of Technological Skills, which measured students' competencies in operational and technical skills, information and digital literacy, communication and collaboration, and digital content creation, problem-solving, and adaptability through 32 items adapted from the DigComp 2.2 Framework of Vuorikari, Kluzer, and Punie (2022); and (3) Extent of Technology Integration in Science Learning, which assessed students' personal use of technology, instructional support, and collaborative learning practices through 24 items adapted from Garcia, Santos, and Dizon (2020). The second and third parts used a four-point Likert scale, ranging from Slightly Skilled to Highly Skilled and Low Extent to Very High Extent, respectively. The data gathered served as the basis for developing a Proposed Technology Integration Plan for Science Learning.

Validation and Test of Reliability of the Instrument

The adapted survey questionnaire underwent content validation by three experts in science education, educational research, and educational technology to ensure the clarity, relevance, and appropriateness of its items. Their comments and recommendations were incorporated through revisions, simplification, and refinement of statements to ensure alignment with the research objectives. The revised questionnaire was pilot-tested among 20 Grade 11 students who were not included in the actual respondents. The responses were analyzed using Cronbach's Alpha, yielding a reliability coefficient of 0.867, indicating high internal consistency. Thus, the instrument was considered valid, reliable, and suitable for the actual data collection.

Data Gathering Procedure

The data-gathering process was conducted during the second grading period of School Year 2025–2026, after securing approval from the DepEd–Division of Davao City, the school principal, and the required ethical clearance. The researcher coordinated with the Grade 11 and 12 LASH focal person and class advisers for the administration of the validated survey questionnaire, which was distributed in printed or digital format. Before answering, respondents were oriented about the study, informed of their rights, and assured of the confidentiality and voluntary nature of their participation. Sufficient

time was provided for completing and submitting the questionnaires. The researcher then coordinated with the class advisers and school records custodian to obtain the respondents' official second-grading science grades, with the necessary consent and authorization. Finally, all collected responses and academic records were coded, organized, and anonymized before statistical analysis to ensure data accuracy, confidentiality, and compliance with research ethics.

Statistical Treatment of Data

The data gathered in this study were analyzed using the following statistical methods:

Frequency and Percentage were used to determine the demographic profile of the respondents.

Mean and Standard Deviation were used to determine the level of technological skills of the respondents.

Mean and Standard Deviation were used to assess the extent of technology integration in science learning.

One-way Analysis of Variance (ANOVA) was used to assess the level of technological skills of the respondents, grouped by profile.

One-way Analysis of Variance (ANOVA) was used to assess the extent of technology integration in science learning among respondents, grouped by profile.

Pearson's correlation was used to determine whether there is a significant relationship between the level of technological skills and the extent of technology integration in science learning.

Ethical Considerations

The study observed the ethical principles of respect for persons, beneficence, and justice to protect the rights, welfare, privacy, and dignity of all respondents (BPS, 2021; Thongprasert & Phathong, 2021). Necessary permissions and ethical clearance were secured, while informed consent from respondents and their parents or guardians, when required, was obtained before participation. Respondents were informed of the study's purpose, assured that participation was voluntary, and allowed to withdraw without penalty or academic consequences. The researcher also ensured fair treatment, minimized potential risks, and maintained confidentiality by using codes instead of names and securely handling survey responses and academic records. Furthermore, the study complied with the Data Privacy Act of 2012 (Republic Act No. 10173), ensuring that all collected information was used solely for research purposes and reported in summarized form to protect the identities of the participants.

RESULTS AND DISCUSSION

Problem No. 1: What is the demographic profile of the respondents in terms of age, sex, civil status, Grade Level, and employment status?

Table 1.1 presents the age distribution of the 150 respondents.

Table 1 .1

Demographic Profile of the Respondents in Terms of Age

	Frequency	Percent
15	1	0.7
16	7	4.7
17	12	8.0
18	25	16.7
19	20	13.3
20	15	10.0
21 and above	70	46.7
Total	150	100.0

The table shows that the largest proportion of respondents belonged to the 21-year-old and above age group, comprising 70 or 46.7% of the sample. This was followed by those aged 18 (25 or 16.7%), 19 (20 or 13.3%), 20 (15 or 10.0%), and 17 (12 or 8.0%). Meanwhile, 7 respondents (4.7%) were 16 years old, while only 1 (0.7%) was 15 years old. Overall, the findings indicate that nearly half of the respondents were aged 21 and above, reflecting a relatively diverse age distribution among the learners.

The predominance of older learners may reflect differences in educational backgrounds and schooling experiences, which may also influence their exposure to and familiarity with digital technologies. Previous studies have shown that learners' digital competence and technology-use practices may vary across age groups and personal circumstances (Khan et al., 2022; Sánchez et al., 2023; Hossain et al., 2023). However, age alone does not necessarily determine technological skills, as other factors, including access, experience, and learning opportunities, may also influence digital competence (Cabero-Almenara et al., 2022). Thus, age serves primarily as contextual information in understanding the respondents' profiles and technology-related learning experiences.

Table 1.2 presents the sex distribution of the 150 respondents.

Table 1.2
Demographic Profile of the Respondents in Terms of Sex

	Frequency	Percent
Male	62	41.3
Female	88	58.7
Total	150	100.0

The table shows that 88 respondents (58.7%) were female, while 62 (41.3%) were male, indicating a higher proportion of female participants. This distribution may reflect the actual composition of the target population and serves as demographic information for understanding the respondents. However, sex alone does not determine a learner's technological competence or ability to integrate technology into science learning. Qazi et al. (2022) found that gender differences in ICT use and skills were relatively small and varied depending on the skills examined. Similarly, Campos and Scherer (2024) reported differences in digital competence between male and female students, although these were influenced by contextual factors. Thus, the greater number of female respondents should be interpreted as a characteristic of the sample rather than evidence of higher technological skills, with any significant differences requiring appropriate statistical analysis.

Table 1.3 presents the demographic profile of the respondents in terms of civil status.

Table 1.3
Demographic Profile of the Respondents in Terms of Civil Status

	Frequency	Percent
Single	143	95.3
Married	7	4.7
Total	150	100

The table shows that the majority of the respondents were single, comprising 143 or 95.3% of the sample, while only 7 or 4.7% were married. This indicates that the respondents were predominantly single, which may be associated with their age and educational background. However, civil status should be considered a demographic characteristic rather than a direct indicator of technological skills or technology integration in science learning. UNESCO (2023) and OECD (2023) emphasized that learners' educational experiences are influenced by various personal, social, and demographic circumstances. Thus, the distribution provides contextual information about the respondents, while any possible relationship between civil status and the study's major variables must be established through appropriate statistical analysis.

Table 1.4 presents the demographic profile of the respondents in terms of grade level.

Table 1.4
Demographic Profile of the Respondents in Terms of Grade Level

	Frequency	Percent
Grade 11	45	30.0
Grade 12	105	70.0
Total	150	100.0

The table shows that 105 respondents (70.0%) were Grade 12 learners, while 45 (30.0%) were Grade 11 learners, indicating that the sample was predominantly composed of senior-level students. This may reflect the actual distribution of the target population and provides context for understanding the respondents' educational experiences. According to Fraillon et al. (2020) and OECD (2023), students' digital competence is influenced by their exposure to technology and

opportunities to use digital tools in learning environments. Although Grade 12 learners may have had more exposure to technology-supported activities, grade level alone does not establish higher technological competence. Therefore, any differences in technological skills and technology integration between the two grade levels should be determined through appropriate statistical analysis.

Table 1.5 presents the employment status of the 150 respondents.

Table 1.5
Demographic Profile of the Respondents in Terms of Employment Status

	Frequency	Percent
Employed (Full-time)	20	13.3
Employed (Part-time)	51	34.0
Self-employed / Business Owner	12	8.0
Unemployed / Currently Not Employed	67	44.7
Total	150	100.0

The findings show that 67 respondents (44.7%) were unemployed, 51 (34.0%) were working part-time, 20 (13.3%) were employed full-time, and 12 (8.0%) were self-employed or business owners. This indicates that 45.3% of the respondents were engaged in some form of employment while pursuing their studies. Balancing academic and work responsibilities may influence students' time management, access to learning resources, and opportunities for technology use. Pagon and Ponce (2021) and Darolia (2014) emphasized that employment circumstances and workload may affect students' academic experiences differently. Thus, employment status provides relevant background information for understanding the respondents' learning experiences, although its actual relationship with technological skills and technology integration must be established through statistical analysis.

Problem No. 2: What is the level of technological skills of the respondents in terms of operational and technical skills, information and digital literacy skills, communication and collaboration skills, and problem-solving and digital productivity skills?

Table 2.1 presents the level of technological skills of the respondents in terms of operational and technical skills.

Table 2.1
Level of Technological Skills of the Respondents in Terms of Operational and Technical Skills

	M	VI
1. I can operate digital devices such as smartphones, tablets, and computers for science learning.	2.84	High Level
2. I can connect and configure digital devices needed for science activities.	3.13	High Level
3. I can install, open, update, and manage applications used for science learning.	2.77	High Level
4. I can adjust basic settings of digital devices to support my science learning activities.	2.93	High Level
5. I can troubleshoot basic technical problems when using digital tools.	2.91	High Level
6. I can manage, organize, and retrieve digital files and documents effectively.	2.46	Moderate Level
7. I can use different digital devices and applications without constant assistance.	2.67	High Level
8. I can maintain the proper use and care of digital devices used for learning.	2.79	High Level
Operational and Technical Skills	**2.81**	High Level

Legend: *3.25 - 4.00 = Very High Level (VH), 2.51 – 3.24 = High Level (H), 1.76 – 2.50 = Moderate Level (M), and 1.00 - 1.75 = Low Level (L)*

The findings reveal that the respondents generally demonstrated a High Level of operational and technical skills, with an overall mean of 2.81. Their highest-rated skill was connecting and configuring digital devices for science activities (M = 3.13), indicating confidence in performing basic technological operations. However, managing, organizing, and retrieving digital files obtained the lowest mean of 2.46, interpreted as Moderate, suggesting a need to strengthen their file management skills. This finding is consistent with Galve and Labio (2023) and Siddiq et al. (2016), who emphasized that digital competence involves not only operating devices but also managing and organizing digital information effectively. Thus, while the respondents possessed adequate foundational technological skills, further learning opportunities are needed to improve their digital organization and information-management abilities for more effective science learning.

Table 2.2 presents the level of technological skills of the respondents in terms of information and digital literacy skills.

Table 2.2
Level of Technological Skills of the Respondents in Terms of Information and Digital Literacy Skills

	M	VI
1. I can search for reliable online sources related to science topics.	3.06	High Level
2. I can identify keywords when searching for science-related information online.	3.18	High Level
3. I can evaluate whether online science information is accurate and credible.	3.02	High Level
4. I can distinguish reliable sources from unreliable sources when gathering science information.	2.73	High Level
5. I can properly use digital resources such as e-books, websites, and online databases.	2.77	High Level
6. I can organize and save digital information collected for my science tasks.	2.97	High Level
7. I can properly cite or acknowledge online sources used in science activities.	2.99	High Level
8. I can use online information to improve my understanding of science concepts.	2.76	High Level
Information and Digital Literacy Skills	**2.94**	High Level

Legend: *3.25 - 4.00 = Very High Level (VH), 2.51 – 3.24 = High Level (H), 1.76 – 2.50 = Moderate Level (M), and 1.00 - 1.75 = Low Level (L)*

The findings reveal that the respondents demonstrated a High Level of information and digital literacy skills, with a composite mean of 2.94. Their highest-rated skill was identifying appropriate keywords when searching for science-related information online (M = 3.18), followed by finding reliable online sources (M = 3.06). However, distinguishing reliable from unreliable sources received the lowest mean of 2.73, although still interpreted as High. This suggests that while students were capable of locating online information, evaluating its credibility remained an area for improvement. These findings are consistent with Galve and Labio (2023), Delima et al. (2023), and Siddiq et al. (2016), who emphasized that digital literacy involves not only accessing information but also critically evaluating and appropriately using it. Therefore, students should be provided with learning activities that strengthen source evaluation, information verification, and critical thinking to promote more responsible and effective use of digital resources in science learning.

Table 2.3 presents the level of technological skills of the respondents in terms of communication and collaboration skills.

Table 2.3
Level of Technological Skills of the Respondents in Terms of Communication and Collaboration Skills

	M	VI
1. I can communicate with classmates using appropriate digital platforms.	3.23	High Level
2. I can participate actively in online discussions about science topics.	3.23	High Level
3. I can use video-conferencing tools for school-related activities.	3.09	High Level
4. I can share digital files and resources with my classmates.	3.06	High Level
5. I can contribute ideas to group activities using digital platforms.	3.05	High Level
6. I can collaborate with classmates using shared online documents or platforms.	3.01	High Level
7. I can communicate my ideas clearly through digital tools.	3.05	High Level
8. I observe appropriate behavior and respect when communicating online.	2.87	High Level
Communication and Collaboration Skills	**3.08**	High Level

Legend: *3.25 - 4.00 = Very High Level (VH), 2.51 – 3.24 = High Level (H), 1.76 – 2.50 = Moderate Level (M), and 1.00 - 1.75 = Low Level (L)*

The findings reveal that the respondents demonstrated a High Level of communication and collaboration skills, with a composite mean of 3.08. Their highest-rated skills were communicating with classmates through appropriate digital platforms and actively participating in online science discussions (both M = 3.23), indicating confidence in using technology to exchange ideas and collaborate with peers. However, observing appropriate behavior and respect when communicating online received the lowest mean of 2.87, although still interpreted as High. This suggests that while learners were comfortable with digital communication, responsible online interaction and proper netiquette may need further reinforcement. These findings are supported by Burgos et al. (2023) and Delima et al. (2022), who emphasized the importance of digital communication and collaboration in students' learning experiences. Therefore, integrating digital citizenship and collaborative activities into science instruction may further strengthen learners' ability to use technology effectively, respectfully, and responsibly.

Table 2.4 presents the level of technological skills of the respondents in terms of problem-solving and digital productivity skills in using technology for science-related learning activities.

Table 2.4
Level of Technological Skills of the Respondents in Terms of Problem-Solving and Digital Productivity Skills

	M	VI
1. I can select appropriate digital tools for completing science-related tasks.	3.27	Very High Level
2. I can use technology to solve problems encountered in my schoolwork.	2.90	High Level
3. I can learn how to use unfamiliar digital applications when needed.	2.95	High Level
4. I can create digital presentations for science-related activities.	2.81	High Level
5. I can create or edit digital documents for my science requirements.	2.93	High Level
6. I can use spreadsheets or similar tools to organize information or data.	2.87	High Level
7. I can use digital tools to present scientific information clearly.	2.77	High Level
8. I can combine different digital tools to complete a science-related task efficiently.	2.90	High Level
Problem Solving and Digital Productivity Skills	**2.92**	High Level

Legend: *3.25 - 4.00 = Very High Level (VH), 2.51 – 3.24 = High Level (H), 1.76 – 2.50 = Moderate Level (M), and 1.00 - 1.75 = Low Level (L)*

The findings reveal that the respondents demonstrated a High Level of problem-solving and digital productivity skills, with a composite mean of 2.92. Their strongest skill was selecting appropriate digital tools for science-related tasks (M = 3.27), interpreted as Very High, indicating confidence in choosing technologies suited to specific learning activities. However, presenting scientific information clearly using digital tools received the lowest mean of 2.77, although still interpreted as High. This suggests that while learners can identify suitable digital resources, they may need more practice in organizing and presenting scientific information effectively. These findings are consistent with UNESCO (2023) and Galve and Labio (2023), who emphasized problem-solving, digital content creation, and higher-level productivity as essential components of digital competence. Therefore, providing hands-on activities such as data analysis, graphing, infographic creation, and digital presentations may further strengthen learners' ability to use technology meaningfully in science learning.

Table 2.5 presents the Composite table on the level of technological skills of the respondents.

Table 2.5
Composite Table on the Level of Technological Skills of the Respondents

	M	VI
Operational and Technical Skills	2.81	High Level
Information and Digital Literacy Skills	2.94	High Level
Communication and Collaboration Skills	3.08	High Level
Problem Solving and Digital Productivity Skills	2.92	High Level
Level of Technological Skills	**2.94**	High Level

Legend: *3.25 - 4.00 = Very High Level (VH), 2.51 – 3.24 = High Level (H), 1.76 – 2.50 = Moderate Level (M), and 1.00 - 1.75 = Low Level (L)*

The findings reveal that the respondents demonstrated a High Level of technological skills, with an overall composite mean of 2.94. Among the four dimensions, communication and collaboration skills obtained the highest mean (M

= 3.08), followed by information and digital literacy (M = 2.94), problem-solving and digital productivity (M = 2.92), and operational and technical skills (M = 2.81). These results indicate that learners were generally capable of using digital technologies for communication, information gathering, collaboration, and science-related academic tasks. However, the comparatively lower ratings in operational and technical skills suggest the need for more hands-on technology activities, while critical information evaluation and digital content creation also warrant further development. Overall, the findings suggest that learners have a good technological foundation that can be strengthened through purposeful and meaningful integration of digital technologies in science learning.

Problem No. 3: What is the extent of technology integration in science learning in terms of personal learning practices, instructional support, and collaborative learning?

Table 3.1 presents the extent of technology integration in Science learning in terms of personal learning practices.

Table 3.1
Extent of Technology Integration in Science Learning in Terms of Personal Learning Practices

	M	VI
1. I watch science videos or tutorials online to understand lessons better.	2.78	Integrated
2. I use productivity tools (Word, Excel, Canva) for science assignments.	3.10	Integrated
3. I use mobile apps or websites to practice science concepts.	2.93	Integrated
4. I review science lessons using online quizzes or games.	2.87	Integrated
5. I search for additional online resources to supplement my science learning.	2.85	Integrated
6. I take notes digitally (e.g., typing, screenshots, e-notes) for science.	3.00	Integrated
7. I record or replay science lessons using gadgets for review.	3.03	Integrated
8. I use translation or accessibility tools (e.g., Google Translate, text-to-speech) to understand science content.	2.92	Integrated
Personal Use of Technology in Science Learning	**2.93**	**Integrated**

Legend: 3.25 - 4.00 = Highly Integrated (HI), 2.51 – 3.24 = Integrated (I), 1.76 – 2.50 = Moderately Integrated (MI), and 1.00 - 1.75 = Not Integrated (NI)

The findings reveal that technology was Integrated into the respondents' personal learning practices, with a composite mean of 2.93. Their most common practice was using productivity tools such as Word, Excel, and Canva for science assignments (M = 3.10), followed by using gadgets to record or replay lessons for review (M = 3.03). Meanwhile, watching online science videos or tutorials received the lowest mean of 2.78, although still interpreted as Integrated. This suggests that learners more frequently used technology to complete academic requirements and review lessons than to seek supplementary video-based explanations. Consistent with the OECD's PISA 2022 findings, the results highlight the growing role of digital technologies in students' learning experiences. Overall, technology had become a regular part of learners' independent science learning, supporting assignment completion, lesson review, and access to learning resources.

Table 3.2 presents the extent of technology integration in Science learning in terms of instructional support.

Table 3.2
Extent of Technology Integration in Science Learning in Terms of Instructional Support

	M	VI
1. I use online platforms to submit assignments or assessments in science.	2.87	Integrated
2. I use technology to organize my science notes and outputs.	2.99	Integrated
3. I use digital tools to track or check my progress in science.	2.84	Integrated
4. I consult digital modules or e-books provided by the school for science.	2.73	Integrated
5. I use search engines to clarify unclear science topics.	2.87	Integrated
6. I replayed recorded science lectures or reviewed posted learning materials.	2.89	Integrated
7. I use online dictionaries, encyclopedias, or academic sites for science.	2.77	Integrated
8. I download and save science resources (PDFs, videos, slides) for future use.	2.67	Integrated
Instructional Support in Science Learning	**2.83**	**Integrated**

Legend: 3.25 - 4.00 = Highly Integrated (HI), 2.51 – 3.24 = Integrated (I), 1.76 – 2.50 = Moderately Integrated (MI), and 1.00 - 1.75 = Not Integrated (NI)

The findings reveal that technology was Integrated as instructional support in science learning, with a composite mean of 2.83. The respondents most commonly used technology to organize their science notes and outputs (M = 2.99), indicating that digital tools helped them manage and access academic materials. Meanwhile, downloading and saving science resources for future use received the lowest mean of 2.67, although still interpreted as Integrated. This suggests that learners may benefit from further developing their digital organization skills, particularly in saving and categorizing useful learning materials. Consistent with Akram et al. (2022), the findings emphasize that the value of technology lies in how it is used to support learning activities. Overall, digital technologies served as useful instructional support by helping learners manage academic tasks, access resources, understand concepts, and reinforce classroom learning.

Table 3.3 presents extent of technology integration in Science learning in terms of collaborative learning.

Table 3.3
Extent of Technology Integration in Science Learning in Terms of Collaborative Learning

	M	VI
1. I use group chats or online forums to discuss science lessons with classmates.	3.09	Integrated
2. I collaborate with peers using shared documents (Google Docs, Sheets, Slides) for science tasks.	2.90	Integrated
3. I participate in group projects that involve technology use in science.	2.85	Integrated
4. I share online resources or materials with classmates to help in science learning.	2.76	Integrated
5. I contribute ideas during online group discussions related to science.	2.89	Integrated
6. I help classmates who struggle with technology use in science.	2.67	Integrated
7. I coordinate group schedules and tasks using apps or messaging platforms for science projects.	2.80	Integrated
8. I engage in peer feedback or peer editing of science tasks using online tools.	2.88	Integrated
Collaborative Learning Practices in Science	**2.85**	**Integrated**

Legend: *3.25 - 4.00 = Highly Integrated (HI), 2.51 – 3.24 = Integrated (I), 1.76 – 2.50 = Moderately Integrated (MI), and 1.00 - 1.75 = Not Integrated (NI)*

The findings reveal that technology was Integrated into the respondents' collaborative learning experiences, with a composite mean of 2.85. Their most common practice was using group chats or online forums to discuss science lessons with classmates (M = 3.09), indicating that digital platforms supported academic communication, idea sharing, and group coordination. In contrast, helping classmates who experienced difficulties using technology received the lowest mean of 2.67, although still interpreted as Integrated. This suggests that learners were more accustomed to using digital tools for communication than providing direct technological assistance to their peers. These findings are supported by Douglas et al. (2023) and Gaad (2022), who highlighted the role of online interaction and collaboration in science learning. Overall, technology facilitated collaborative learning, but peer mentoring, technology sharing, and structured group activities may further strengthen learners' participation and cooperation.

Table 3.4 presents the extent of technology integration in Science learning.

Table 3.4
Composite Table on the Extent of Technology Integration in Science Learning in Terms of Collaborative Learning

	M	VI
Personal Use of Technology in Science Learning	2.93	Integrated
Instructional Support in Science Learning	2.83	Integrated
Collaborative Learning Practices in Science	2.85	Integrated
Extent of Technology Integration in Science Learning	**2.87**	**Integrated**

Legend: *3.25 - 4.00 = Highly Integrated (HI), 2.51 – 3.24 = Integrated (I), 1.76 – 2.50 = Moderately Integrated (MI), and 1.00 - 1.75 = Not Integrated (NI)*

The findings reveal that technology was Integrated into the respondents' science learning, with an overall composite mean of 2.87. Personal learning practices obtained the highest mean (M = 2.93), followed by collaborative learning (M = 2.85) and instructional support (M = 2.83). Despite these slight differences, all three dimensions were interpreted as Integrated, indicating that learners used technology for independent study, academic collaboration, and instructional

activities. The relatively close mean scores suggest that technology was incorporated into different aspects of their science learning rather than being limited to a single purpose. Consistent with UNESCO (2023) and Akram et al. (2022), the findings emphasize the importance of purposeful technology use in supporting meaningful learning experiences. Overall, digital technologies served as useful resources for strengthening independent learning, peer collaboration, and engagement with science instruction.

Problem No. 4: Is there a significant difference in the level of technological skills of the respondents when grouped according to their demographic profile?

Table 4 presents the significant difference in the level of technological skills of the respondents when grouped according to their demographic profile.

Table 4.
Significant Difference in the Level of Technological Skills of the Respondents When Grouped According to their Demographic Profile

	Mean Square	F	Sig.	Decision	Remarks
Age	2.723	1.010	0.477	Accept	Not Significant
Sex	0.188	0.661	0.957	Accept	Not Significant
Civil Status	0.050	1.235	0.181	Accept	Not Significant
Senior High School Grade Level	0.233	1.187	0.229	Accept	Not Significant
Employment Status	1.491	1.275	0.147	Accept	Not Significant

Table 4 presents the test of significant differences in the respondents' technological skills when grouped according to age, sex, civil status, grade level, and employment status. The results show no statistically significant differences across all demographic variables, with significance values of 0.477, 0.957, 0.181, 0.229, and 0.147, respectively, all exceeding the 0.05 level of significance. This indicates that the respondents had comparable levels of technological skills regardless of their demographic characteristics. The findings suggest that technological competence may be influenced by various individual and contextual factors rather than demographic characteristics alone. This is consistent with Campos and Scherer (2024), Qazi et al. (2022), and Karpiński et al. (2023), who emphasized that digital skills are shaped by different factors and that demographic differences do not consistently determine digital competence. Although Galve and Labio (2023) reported differences in ICT skills across academic tracks, their findings on sex were consistent with the present study.

Overall, the results indicate that age, sex, civil status, grade level, and employment status did not significantly differentiate the respondents' technological skills. Thus, there was insufficient evidence to reject the null hypothesis, which was accepted based on the study's decision rule. These findings highlight the importance of providing inclusive and equitable opportunities for all learners to develop their technological competencies. Through meaningful science-related activities involving digital research, communication, collaboration, problem-solving, and content creation, students can further strengthen their skills regardless of their demographic background.

Problem No. 5: Is there a significant difference in the extent of technology integration in science learning when grouped according to their demographic profile?

Table 5 presents the significant difference in the extent of technology integration in science learning when grouped according to their demographic profile.

Table 5.
Significant Difference in the Extent of Technology Integration in Science Learning When Grouped According to Their Demographic Profile

	Mean Square	F	Sig.	Decision	Remarks
Age	2.586	0.939	0.581	Accept	Not Significant
Sex	0.215	0.842	0.733	Accept	Not Significant
Civil Status	0.054	1.302	0.141	Accept	Not Significant
Senior High School Grade Level	0.157	0.675	0.925	Accept	Not Significant
Employment Status	1.551	1.286	0.152	Accept	Not Significant

Table 5 presents the test of significant differences in the extent of technology integration in science learning when the respondents are grouped according to age, sex, civil status, grade level, and employment status. The results indicate that none of the demographic variables resulted in a statistically significant difference in the respondents' extent of technology integration. The significance values were 0.581 for age, 0.733 for sex, 0.141 for civil status, 0.925 for grade level, and 0.152 for employment status. Since all these values are higher than the 0.05 level of significance, the differences observed among the groups are not statistically significant. This means that the respondents generally reported comparable levels of technology integration in their science learning regardless of their demographic characteristics.

In terms of age, the obtained significance value of 0.581 indicates that there was no significant difference in technology integration among the different age groups. Although the respondents belonged to varying age categories, their reported use of technology for science learning was relatively similar. This suggests that, within the group covered by the study, age did not appear to be a factor that distinguished learners in terms of their use of technology for academic purposes. The finding is consistent with the broader understanding that students' technology use is influenced by several factors, including their learning experiences, access to digital resources, and the opportunities provided by their educational environment, rather than by age alone.

The same result was observed for sex, which obtained a significance value of 0.733. This indicates that male and female respondents did not differ significantly in the extent to which they integrated technology into their science learning. Their comparable results suggest that both groups were using technology for learning in relatively similar ways. This finding is worth noting because studies on gender and digital technology have produced varying results across different settings. Qazi et al. (2022), for example, found that gender differences in ICT use and skills were not uniform across studies and depended on the technology or digital skill examined. Thus, the present findings suggest that sex did not serve as a meaningful basis for distinguishing technology integration among the respondents.

Likewise, civil status, grade level, and employment status did not produce statistically significant differences, with significance values of 0.141, 0.925, and 0.152, respectively. The result for grade level is particularly notable because the very high significance value indicates that Grade 11 and Grade 12 learners had comparable levels of technology integration in science learning. Being in a higher grade level, therefore, did not necessarily correspond to greater use of technology within the context of this study. Similarly, employed and non-employed learners did not differ significantly in their reported technology integration. While learners may have different experiences with technology outside the classroom, these differences were not reflected in statistically significant variations in their science-related technology use.

The findings may be partly explained by the increasingly familiar role of digital technology in students' academic lives. Learners commonly encounter technology when searching for information, completing assignments, communicating with classmates, preparing digital outputs, accessing learning resources, and reviewing lessons. UNESCO (2023) emphasized that the contribution of technology to education depends not merely on whether digital tools are available but on whether they are used appropriately and purposefully to support learning. In this regard, the similar levels of technology integration reported by the respondents may reflect their shared exposure to technology-supported learning activities within the school environment.

Furthermore, Akram et al. (2022) emphasized that meaningful technology integration is closely connected with instructional and pedagogical practices. Technology becomes more valuable when it is deliberately incorporated into learning activities rather than being used simply because digital tools are available. This perspective provides a useful way of understanding the present results. The absence of significant differences across the demographic groups may indicate that the respondents were experiencing relatively similar technology-supported learning practices in their science classes. Thus, their technology integration may be more closely related to common learning opportunities and classroom practices than to their age, sex, civil status, grade level, or employment status.

Taken together, the findings show that age, sex, civil status, grade level, and employment status did not significantly differentiate the respondents' extent of technology integration in science learning. Since all significance values exceeded the 0.05 level of significance, there was insufficient evidence to reject the null hypothesis; consequently, the null hypothesis was accepted based on the decision rule of the study. The results suggest that technology integration was relatively consistent

across the demographic groups included in the analysis. Rather than concentrating technology-related interventions on a particular demographic group, the findings support the continued provision of equitable and meaningful technology-supported learning experiences for all learners. Such opportunities may include activities that encourage students to search for and evaluate information, collaborate through digital platforms, organize learning materials, solve science-related problems, and communicate scientific ideas using appropriate digital tools.

Problem No. 6: Is there a significant relationship between the respondents' level of technological skills and the extent of technology integration in science learning?

Table 6 shows the significant relationship between the respondents' level of technological skills and the extent of technology integration in science learning.

Table 6

Significant Relationship Between the Respondents' Level of Technological Skills and the Extent of Technology Integration in Science Learning

		Extent of Technology Integration in Science Learning
Level of Technological Skills	Pearson Correlation	.516**
	Sig. (2-tailed)	0.000
	N	150

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

Table 6 presents the relationship between the respondents' level of technological skills and their extent of technology integration in science learning. The results show a Pearson correlation coefficient of r = 0.516, indicating a positive moderate relationship between the two variables. This suggests that respondents who demonstrated higher levels of technological skills also tended to report greater use of technology in their science learning. The obtained significance value of 0.000, based on 150 respondents, is lower than the 0.01 level of significance, confirming that the relationship between the two variables is statistically significant. Therefore, the null hypothesis stating that there is no significant relationship between technological skills and technology integration in science learning was rejected.

The positive correlation suggests that learners' ability to use digital technologies is related to how frequently and purposefully they incorporate technology into their science learning activities. Students who are more comfortable operating digital devices, searching for information, communicating through digital platforms, and using technology to accomplish academic tasks may be more likely to integrate these tools into their learning. However, the result should be interpreted as an association and not as evidence of a cause-and-effect relationship. The correlational finding does not establish that higher technological skills directly cause greater technology integration.

The present finding is consistent with Galve and Labio (2023), who reported a positive and significant relationship between ICT skills and digital literacy, with an r value of 0.599. Both the present study and its findings point to the close connection between learners' technological capabilities and their ability to engage with digital technologies for learning. Although the correlation obtained in the present study is somewhat lower, both results indicate a positive pattern, suggesting that students with stronger technological competencies tend to demonstrate greater capacity to use technology in educational contexts.

The finding can also be understood in terms of the practical demands of technology-supported science learning. Learners are often expected to use digital tools to search for scientific information, organize learning resources, communicate with classmates, prepare presentations, complete assignments, and perform other science-related tasks. Having the necessary technological skills may make these activities easier to accomplish and may encourage students to use digital tools more confidently. In this regard, the literature reviewed in the study emphasizes that technology integration becomes more meaningful when learners possess the competencies needed to use digital tools appropriately and when these tools are connected to clear learning purposes.

The result also highlights the importance of providing learners with continuous opportunities to practice technological skills through authentic science learning activities. Merely having access to digital devices may not be sufficient; students also need opportunities to apply their skills in situations that require them to search, evaluate, communicate, collaborate, create, and solve problems using technology. Such experiences may help learners become more comfortable with

digital tools and may support their participation in technology-supported learning activities. The results indicate a statistically significant positive relationship between technological skills and technology integration in science learning among the 150 respondents. With an r value of 0.516, the relationship may be described as moderate and positive, while the significance value of 0.000 confirms that the relationship is statistically significant at the 0.01 level. Thus, the null hypothesis was rejected. The findings suggest that learners with higher technological skills tend to demonstrate greater technology integration in science learning. This emphasizes the value of strengthening students' technological competencies while providing meaningful opportunities for them to apply these skills in actual science learning situations.

Problem No. 7 Based on the findings of the study, what output may be developed?

TECH-SMART: TECHnological Skills for Science Mastery and Application through Responsive Technology

I. Rationale

Based on the findings of the study, the TECH-SMART Action Plan (TECHnological Skills for Science Mastery and Application through Responsive Technology) is proposed to strengthen students' technological skills and promote effective technology integration in science learning. The plan addresses six domains: Operational and Technical Skills, Information and Digital Literacy, Communication and Collaboration Skills, Technology Integration in Terms of Personal Learning Practices, Instructional Support, and Collaborative Learning. It includes targeted activities such as digital file management workshops, science source verification, digital citizenship sessions, science video learning logs, digital resource organization, and peer-assisted technology activities. These interventions aim to help students manage digital files effectively, evaluate the credibility of scientific information, communicate responsibly online, use digital resources for independent learning, access instructional materials, and assist classmates in using technology for science-related tasks. Through the collaborative efforts of science teachers, ICT teachers, class advisers, and students, the action plan will be implemented progressively throughout the academic year and monitored using assessment results, student outputs, teacher observations, and participant feedback. The results of monitoring and evaluation will serve as a basis for refining the interventions and ensuring that the program remains responsive to students' learning needs while fostering confident, responsible, and purposeful use of technology to enhance science learning.

II. Objectives

1. Improve students' ability to manage, organize, save, and retrieve digital files and science-related documents.
2. Strengthen students' ability to identify and evaluate reliable sources of scientific information using appropriate digital literacy criteria.
3. Develop students' awareness and practice of responsible, respectful, and appropriate online communication during science-related learning activities.
4. Encourage students to use online science videos and tutorials as supplementary resources for independent learning and improved conceptual understanding.
5. Improve students' ability to download, organize, store, and retrieve digital instructional materials for future reference and independent study.
6. Promote peer assistance and collaborative learning by encouraging students to support classmates who experience difficulties using technology for science learning.
7. Establish a systematic monitoring and evaluation process to measure students' progress, assess the effectiveness of interventions, and guide the improvement of subsequent program implementation.

III. TECH-SMART Action Plan

Key Result Area	Objectives	Strategies / Activities	Persons Involved	Time Frame	Source of Fund	Success Indicators
Operational and Technical Skills	To develop students' ability to manage, organize, save, and retrieve	Digital File Management Workshop: Demonstrate how to create folders, apply systematic file-naming conventions, organize	Science teachers, ICT teachers, students	Term 1	School MOOE, available ICT resources,	At least 90% of participating students can correctly organize, save, and retrieve science-related digital

	digital science files and documents efficiently.	science documents, save files in appropriate locations, and retrieve previously stored outputs. Require students to organize sample science files using a prescribed folder structure.			and existing school facilities	files based on a performance checklist. Each student maintains an organized digital science folder.
Information and Digital Literacy	To enhance students' ability to evaluate the credibility, accuracy, relevance, and reliability of online scientific information before using it for academic purposes.	Science Source Verification Challenge: Provide examples of science websites, online articles, and educational videos. Guide students in evaluating author credentials, accuracy, publication date, supporting evidence, references, and source credibility. Ask students to justify their selection of reliable sources.	Science teachers, ICT teachers, students	Term 1	School MOOE, existing internet facilities, and free online educational resources	At least 90% of participating students meet the proficiency standard established in the source evaluation rubric. Students produce a completed source evaluation checklist and a list of credible science references.
Communication and Collaboration Skills	To promote responsible digital citizenship by developing students' ability to communicate respectfully, practice appropriate online behavior, and participate constructively in science-related digital discussions.	Digital Citizenship and Netiquette Sessions: Establish guidelines for respectful communication in online science discussions, learning platforms, and authorized class group chats. Use role-playing activities and sample online interactions to demonstrate appropriate responses, respectful disagreement, and responsible digital behavior.	Science teachers, class advisers, students	Term 2	School MOOE, existing digital learning platforms, and teacher-developed learning materials	At least 90% of participating students meet the expected performance level on a digital communication rubric. A written set of online communication guidelines is adopted for science-related activities.
Technology Integration in Terms of Personal Learning	To encourage students to use appropriate online science videos and	Science Video Learning Logs: Ask students to select teacher-approved science videos or tutorials relevant to current lessons. Require	Science teachers, students	Term 2	School MOOE, free educational video	At least 90% of participating students regularly complete learning logs that satisfy the established

Practices	tutorials for independent learning, concept reinforcement, and reflection on their understanding of science lessons.	students to record the topic, summarize important concepts, identify newly learned information, and explain how the video supports their understanding.			platforms, and students' available digital devices	criteria for accuracy, relevance, and reflection. Completed learning logs are maintained as evidence of independent learning.
Instructional Support	To improve students' ability to access, download, organize, store, and retrieve digital science instructional materials for future reference, independent study, and completion of learning activities.	Science Digital Resource Bank: Compile teacher-curated modules, presentations, simulations, worksheets, and reference materials. Demonstrate how to download, save, categorize, and retrieve resources. Provide offline copies or alternative access arrangements for students with limited internet connectivity.	Science teachers, ICT teachers, students	Term 3	School MOOE, existing ICT facilities, free educational resources, and available digital storage facilities	At least 90% of participating students can maintain an organized collection of science resources and retrieve selected materials during practical assessment. The resource bank is updated regularly and contains appropriately identified learning materials.
Collaborative Learning	To strengthen peer collaboration and develop students' ability to provide appropriate technological assistance to classmates who encounter difficulties in using digital tools and resources for science learning.	Tech-Buddy Peer Assistance Program: Pair or group students according to identified learning needs. Train student volunteers to assist classmates in accessing learning platforms, managing files, locating credible science resources, and using digital science tools. Document assistance through peer-support logs.	Science teachers, student technology buddies, students	Term 3	School MOOE, existing ICT resources, and available learning materials	At least 85% of participating students report improved confidence in using technology for science learning, supported by pre- and post-program feedback. Peer-support logs document assistance provided and common difficulties addressed.

The TECH-SMART Action Plan (TECHnological Skills for Science Mastery and Application through Responsive Technology) is designed to enhance students' technological skills and promote effective technology integration in science learning. It consists of six domains: Operational and Technical Skills, Information and Digital Literacy, Communication and Collaboration Skills, Technology Integration in Terms of Personal Learning Practices, Instructional Support, and Collaborative Learning. Each domain includes specific activities, such as digital file management workshops, science source verification challenges, digital citizenship sessions, science video learning logs, the establishment of a Science Digital Resource Bank, and the Tech-Buddy Peer Assistance Program. These activities aim to help students manage digital files, evaluate scientific information, communicate responsibly online, use digital resources for independent learning, access instructional materials, and assist classmates in using technology. The plan will be implemented throughout the academic year through the collaborative efforts of science teachers, ICT teachers, class advisers, and students, with support from available school resources and allowable funding sources. Its implementation will be monitored quarterly using performance assessments, student outputs, observation checklists, and feedback forms to determine the achievement of established success indicators and identify areas for improvement. Ultimately, TECH-SMART seeks to foster students' technological competence, independent learning, and collaborative engagement in science education.

IV. Monitoring and Evaluation

The monitoring and evaluation of the TECH-SMART Action Plan will be conducted every Term by science teachers, ICT teachers, and class advisers to assess the implementation of activities and students' progress in developing technological skills and integrating technology into science learning. Monitoring tools, such as performance checklists, assessment rubrics, student outputs, science video learning logs, resource inventories, observation forms, and feedback surveys, will be used to measure the achievement of the established success indicators. The evaluation will focus on students' ability to manage digital files, assess the credibility of online science sources, communicate responsibly in digital environments, use educational videos and digital resources for independent learning, and assist classmates through peer collaboration. At the end of the school year, the results will be consolidated into an accomplishment report to identify achieved targets, implementation challenges, and areas for improvement. The findings will serve as a basis for refining the activities and strengthening the implementation of TECH-SMART in subsequent school years.All paragraphs should be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

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2. SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

Summarizing the study's outcomes using the prescribed methodologies, the findings can be outlined as follows:

1. The profile of the respondents reflects representation across different age groups, sexes, civil statuses, grade levels, and employment-status categories. This profile provides a useful descriptive context for understanding and interpreting the succeeding findings of the study.
2. The respondents generally demonstrated a high level of technological skills. Among the four dimensions, communication and collaboration skills obtained the highest mean, while operational and technical skills obtained the lowest. The ability to manage, organize, and retrieve digital files and documents was comparatively lower, whereas the ability to select appropriate digital tools for science-related tasks obtained the highest individual rating.
3. Technology was generally integrated into science learning. Personal use of technology in science learning obtained the highest mean among the three dimensions, followed by collaborative learning practices and instructional support. This indicates that respondents used digital tools in personal learning activities, instructional-related tasks, and collaborative science activities.
4. No significant difference was found in the respondents' level of technological skills when grouped according to age, sex, civil status, grade level, and employment status. The findings indicate that the

observed differences among the demographic groups were not statistically significant.

5. No significant difference was also found in the extent of technology integration in science learning when respondents were grouped according to age, sex, civil status, grade level, and employment status. This indicates that respondents' reported technology integration was generally comparable across the demographic groups represented in the study.
6. Learners with stronger technological skills tend to demonstrate greater use of technology in their science-related learning activities. The result indicates that technological competence may play an important role in supporting learners' meaningful use of digital technologies in science learning.

Conclusions

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

1. The respondent profile provides relevant contextual information for understanding the composition of the learners included in the study and serves as a basis for interpreting the succeeding findings.
2. Students demonstrated competence in selecting appropriate digital tools for science-related tasks; greater attention may be given to strengthening their ability to manage, organize, and retrieve digital files and documents.
3. Students were able to incorporate digital technologies into their individual learning activities, collaborative tasks, and other science-related academic activities.
4. The respondents' technological skills did not significantly differ across demographic groups. Age, sex, civil status, grade level, and employment status did not produce statistically significant differences in the learners' level of technological skills.
5. The respondents' technology integration in science learning did not significantly differ across demographic groups. Age, sex, civil status, grade level, and employment status were not found to distinguish the extent to which learners integrated technology into their science learning.
6. Technological skills were positively and significantly related to technology integration in science learning. Learners with stronger technological skills tended to demonstrate greater integration of technology in their science-related learning activities.

Recommendations

In view of the foregoing conclusions, the following recommendations are proposed:

1. School administrators and science teachers may establish a learner-responsive technology support mechanism through a technology-access inventory, shared devices, offline resources, flexible digital materials, and appropriate assistance for learners who experience limitations in accessing technology.
2. Science teachers may conduct regular digital skills sessions focusing on file management, digital organization, document retrieval, basic troubleshooting, and efficient use of digital applications. Learners may also be required to maintain organized digital science folders or portfolios and participate in peer-assisted technology activities.
3. Science teachers may integrate purposeful technology-based activities regularly into science instruction, such as virtual laboratories, digital research, spreadsheet-based data analysis, scientific simulations, collaborative online tasks, and digital presentations, ensuring that each activity directly supports the intended science-learning competency.
4. School administrators may provide equitable access to technology-skills development by establishing shared digital resources, scheduling available computer facilities for science classes, and providing offline or small-group alternatives when technological resources or internet connectivity are limited.

5. Science teachers may implement a systematic monitoring and feedback mechanism using technology-integration checklists, performance tasks, digital portfolios, observation records, and learner feedback to identify skills requiring further development and to determine which technology-supported practices should be sustained or improved.
6. School administrators and science teachers may adopt and implement the proposed TECH-SMART Action Plan as a school-based enhancement program. The program may provide structured opportunities for learners to develop technological skills while applying these competencies to authentic and meaningful science-learning activities.
7. The school administration may institutionalize a Needs-Based Support and Development Program by conducting an annual assessment of respondents' needs, implementing activities every term, and preparing individualized intervention plans for those requiring additional assistance. The program may be evaluated every term using documented progress reports, participant feedback, and measurable performance indicators to ensure that the interventions remain responsive to identified needs rather than being based solely on demographic characteristics.

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Cite this Article:

Cheryl D. Suganan, & Claire D. Vico. (2026). Technological skills and technology integration in science among senior high school students. International Journal of Multidisciplinary Research in Arts, Science and Technology (IJMRAST), 4(10), 35–57.

Journal URL: *https://ijmrast.com/* ***DOI:*** *https://doi.org/10.59828/ijmrast.v4i10.326*

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