Green Information and Communication Technology Usage and Health Challenges in Secondary Schools in Bagumbayan District

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Abstract

The adoption of Information and Communication Technology (ICT) in educational institutions has revolutionized the teaching and learning process but its proliferation also raises health concerns aside from its potential ecological effects due to energy consumption and electronic wastes generation. This study investigated the extent of green ICT use and the experienced challenges in secondary schools offering ICT strand in the Bagumbayan District, Bagumbayan, Sultan Kudarat, Mindanao, Philippines. Data were collected through individual surveys among 80 teachers utilizing descriptive correlational research design. Findings reveal that respondents have "good" green ICT practices despite a significant number of teachers lack formal ICT training. Personal mobile phones and laptops are the most commonly used ICT equipment for those users, with varying screen time exposure. Most teachers however are recorded not using ICT equipment when in school. Teachers reported moderate levels of musculoskeletal discomfort experiences, such as neck and back strain. The study highlights the need for enhanced green ICT practices as means of safe educational environment as well as selfcare.

Keywords: *ICT, Safety, Health Effects, Teachers, Computer*

INTRODUCTION

In educational institutions, the adoption of ICT has revolutionized teaching and learning, providing teachers and students with access to a wealth of information and interactive tools for better educational outcomes. However, the widespread use of ICT also raises ecological concerns, as the energy consumption and electronic waste generated by technology can have a significant environmental footprint. It is in this context that green ICT emerged and that is to address the negative environmental concerns of technologies with sustainable initiatives and strategies.

In the Philippines, the consumption of electronic products and services are increasing at an unprecedented rate, leading to a growing accumulation of obsolete equipment electronic waste (e-waste). If systemic policy gaps, low public awareness and weak institutional capacities are not addressed, this area of ICT usage may reach crisis proportions.

On the other hand, ensuring the health and safety of the workforce is essential for maintaining a conducive learning environment. According to the Philippine Statistics Authority (2024), the most commonly reported occupational diseases in 2019 and 2021 were Coronavirus disease 2019 (COVID-19) infection and musculoskeletal disorders such as back pain and neck-shoulder pain where the latter are linked to ICT use.

Despite the importance of green ICT and safety mechanisms in schools, available online literature indicates that research and documentation on these topics remain limited in the educational institutions in the country and in Mindanao. By examining the current practical application gap or state of green ICT and health challenges in secondary schools within Bagumbayan District, valuable insights into the best practices, challenges, and opportunities can be gained. These findings can hopefully lead to future improvements in technology use, green practices adoption, constituent safety and workplace productivity.

METHODOLOGY

The study was conducted in the seven (7) secondary high schools offering ICT strand in the Bagumbayan District, Bagumbayan, Sultan Kudarat with 80 respondents purposively sampled which included ICT coordinators, ICT teachers and Senior High School teachers (Figure 1).
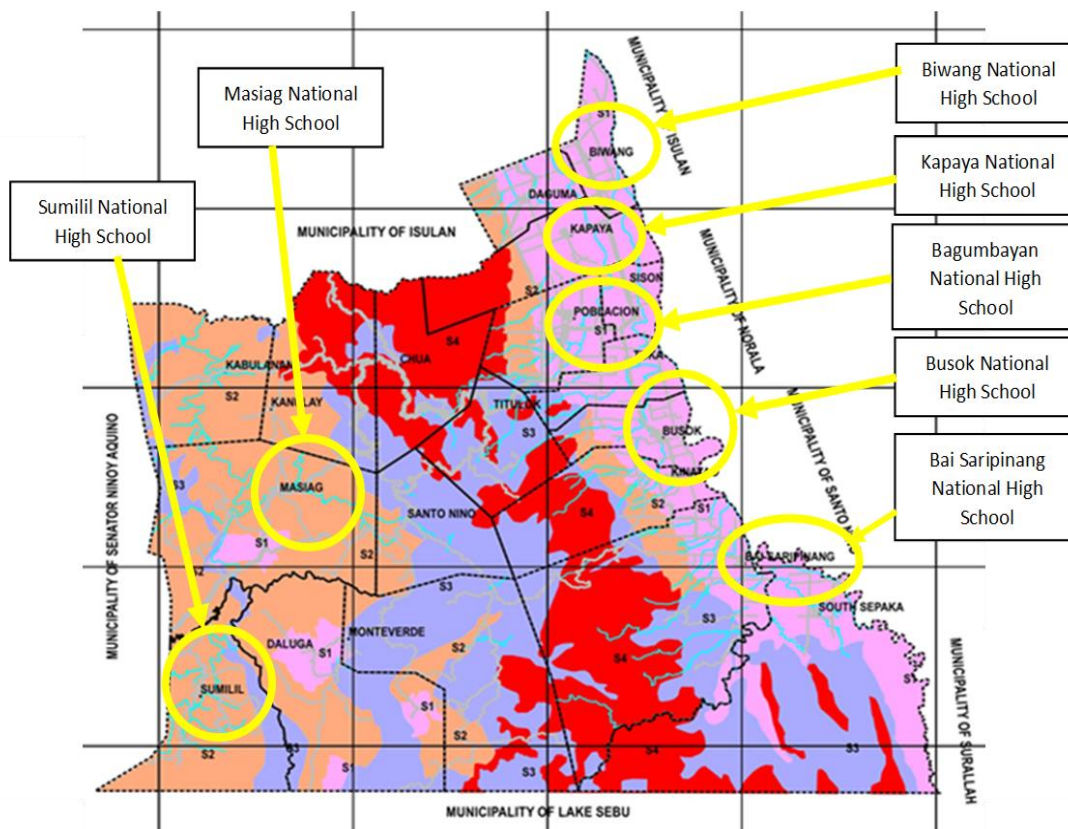
A self-constructed questionnaire wherein some questions were adopted from the different available published materials online regarding Green ICT and health challenges was devised. A four-point Likert's

rating scale was adopted in rating the different item indicators included in the survey instrument (4-Very often; 3-Often; 2-Sometimes; and 1-Never). The intrument was subjected to validity and reliability testing with the assistance of the research adviser, panel members, and statistician through pilot testing among thirty (30) respondents where internal consistency, also known as reliability of survey items were measured using Cronbach's alpha. The reliability result, r = 0.94 indicated that responses are consistent from the first to the second, or the first test is correlated with the second and was very reliable for the target respondents of the study.

On the other hand, the study used descriptive statistical tools. All the data generated were recorded and statistically processed using Statistical Package for Social Sciences (SPSS). Subsequently, the data were analyzed and interpreted through frequency count, percentage, mean, ranking, and Pearson r computations.

Table 1. Scale and verbal descriptions for interpreting the study's numerical data.

Range of Value**	Verbal Description for the Green ICT Practices	Verbal Description for Experienced Health Challenges
3.25 -4.00	Very Good Practice	Extremely experienced
2.51 -3.24	Good Practice	Highly experienced
1.76 -2.50	Acceptable Practice	Moderately experienced
1.00 -1.75	Poor Practice	Slightly experienced

***Source:https://www.extension.iastate.edu/documents/anr/likertscaleexamplesfor surveys.pdf*

RESULTS

Green ICT Usage Characteristics

The teachers' Green ICT usage characteristics examined in this study were the number of trainings attended related to ICT, type and commonly utilized ICT equipment at work; number of years utilizing ICT equipment/gadgets; and the number of hours of screen time exposure or ICT use per day are presented in Tables 2 to 5. This assessment provides insights into their efforts to maximize ICT use and reduce its health and environmental impact.

Number of Trainings Attended

The low participation in ICT training in Table 2 suggests a lack of emphasis or access to professional development in technology, potentially limiting teachers' ability to integrate ICT effectively into their teaching or management roles. There is no wonder why many of the teachers are not engaged into operating many ICT tools available in schools.

The lack of available training programs in ICT use could be attributed to limited ICT facilities or lacking school budget to finance the activities, whereas if addressed could improve employees' competence, job satisfaction, and overall school performance. This requires offering them training, yet in this study, the majority of the teachers were unable to attend any.

Obasi and Benson (2025) stated that the widespread adoption of Information and Communication Technology (ICT), including technologies like artificial intelligence (AI), the Internet of Things (IoT), and big data, is enhancing workplace safety. These innovations enable real-time data collection and analysis, leading to more proactive safety measures and improved decision-making processes.

Table 2. Number of trainings attended by the teachers related to ICT.

Number of Trainings	ICT
3 – with three trainings	1
1 – only one training	6
0 – No training	73
TOTAL	**80**

ICT Equipment used at work

The data in Table 3 shows varied usage levels across different types of equipment. Mobile phones are the most frequently used, with 78 teachers using 1-2 personal devices, emphasizing their importance for communication and accessing educational materials. Laptops are also widely used due to their flexibility for teaching and administrative tasks. Tablets and tablet PCs are less frequently used, suggesting limited access. Many teachers are not using desktops at all, likely due to a preference for portable technology. Specialized equipment like projectors, televisions, and printers show varied usage, with most teachers using only 1-2 units. This indicates that such equipment may not be readily available or necessary for daily tasks. Generally, the data reflects a trend towards the use of portable and multifunctional devices in the workplace.

The teachers' underutilization and lack of interest may stem from the absence of ICT equipment in the workplace. The prevalence of personal devices suggests limited access to school-owned ICT resources. This setup likely impacts teaching quality, especially in tech-reliant subjects. ICT usage is primarily by ICT in-charge or trained subject teachers.

Timotheou, et al. (2023) cited that integrating digital technologies has led to significant shifts in teaching and learning practices. Effective ICT integration impacts not only student performance but also other aspects of the school ecosystem, including teachers and administrative processes. Player-Koro found that teachers' attitudes and beliefs about ICT play a significant role in their classroom. Self-efficacy and attitudes are mutually reinforcing; as teachers become more confident in their ICT skills, their positive attitudes towards its use in education are likely to increase.

Despite this presented advantage of ICT use, limitations are present in the school usage. The explanation of Sánchez and Alemán (2011) could be the reason where they identified several barriers to successful ICT integration, such as infrastructure challenges, lack of resources, and insufficient training for teachers.

Table 3. Type and commonly utilized ICT equipment at work.

Type and commonly utilized ICT equipment at work	Number of Unit/s (School Property/Personally-owned)		
	0	1-2	3 and above
Television	5	71	4
Mobile phone	2	78	0
Laptop	4	76	0

Desktop	72	8	0
Tablet PC	73	7	0
Tablet	63	16	1
Headset	43	37	0
Speaker	49	31	0
Printer	18	62	0
Photocopier	65	15	0
Projector	70	10	0

Number of Years utilizing ICT equipment

As shown in Table 4, majority of teachers have been using ICT equipment for 1-5 years, particularly mobile phones, laptops, and projectors. However, many teachers report no use of desktop computers, tablet PCs, and tablets, suggesting limited or no access to these tools in their work environments.

Furthermore, result indicates that many respondents have relatively recent experience with technology, as seen in the high usage of mobile phones and laptops in the 1-5 years category. Few teachers have used ICT equipment for over 11 years, especially mobile phones. ICT equipment like desktop computers, tablet PCs, and projectors are underutilized, particularly in the 6-10 years and 11 years and above categories, possibly due to their limited relevance or availability in the workplace. This underutilization may reflect the teachers' lack of interest in using them and the schools' lack of prioritization or investment in ICT equipment.

Assessing technology needs and ensuring that the right tools are available and accessible to all employees can improve teaching effectiveness and overall school operations.

Larbi and Nelson (2024) in their study on "Assessment of ICT Facilities Utilization Among Category 'A' Staff (Teaching and Non-Teaching) in Colleges of Education Affiliated with the University of Cape Coast" that widespread use of laptops, desktop computers, and software such as MS Word and PowerPoint bring significant challenges such as insufficient ICT infrastructure, unreliable internet connectivity, and frequent power outages. Despite adequate ICT training for most employees, the study emphasizes the importance of ongoing professional development specifically when there is expanded ICT resources, modernized facilities, and invested strong internet and power infrastructures in schools.

Table 4. Number of years teachers are utilizing ICT equipment.

Type and commonly utilized ICT equipment at work	Number of years utilizing ICT equipment/gadgets			
	0	1-5 Years	6-10 Years	11 Years and above
Television	6	57	16	1
Mobile phone	2	40	28	10
Laptop	4	47	25	4

Desktop	72	2	4	2
Tablet PC	73	7	0	0
Tablet	63	15	2	0
Headset	43	22	13	2
Speaker	49	28	3	0
Printer	18	47	13	2
Photocopier	65	13	1	0
Projector	70	6	3	1

Screen time exposure/use

As shown in Table 5, most teachers report lower levels of screen time, particularly with desktop computers, tablet PCs, and tablets. However, mobile phones, laptops, and televisions show more evenly distributed usage, with many teachers spending 3-4 hours or more on these devices. This duration of screen time are mostly held during the conduct of classes by the teachers.

Desktop computers and tablet PCs have minimal or zero hours usage among many teachers. This indicates that these tools are not widely used in daily work routines, possibly due to limited availability or necessity. Mobile phones and laptops, on the other hand, are integral to teachers' daily work, particularly for communication and administrative tasks, reflecting a significant portion of screen time. The use of televisions also stands out, with some teachers spending up to 5 hours and above, likely for presentations or lessons. However, fewer teachers report spending more than 5 hours daily on ICT devices, which may indicate healthy screen time habits or limitations on prolonged screen use.

Such a trend in the duration of ICT use in a day is similar to the findings in the study by Muslem, et al, (2018) which reported that English Teachers in Indonesia typically spend between I-4 hours a day using ICT.

Table 5. Number of hours of screen time exposure/use per day among teachers.

Type and commonly utilized ICT equipment/gadgets at work	Number of hours of screen time exposure/use per day			
	0	**1-2**	**3-4**	**5 and above**
Television	5	30	24	21
Mobile phone	2	17	33	28

Laptop	4	16	31	29
Desktop	72	5	2	1
Tablet PC	73	4	2	1
Tablet	63	17	0	0

Green ICT Practices

An overall average of 3.06 and a Standard Deviation of 0.48 as shown in Table 6, teachers have "good" green ICT practices related to energy saving, social responsibility, electrical care, and technology usage. While these practices are positive, there are known areas for improvement.

In terms of energy saving, teachers show a strong commitment or "very good practice" like turning off ICT units (mean=2.68, SD=0.63), unplugging equipment, follows installation and service instructions being well observed. Electrical care practices are well-adhered to, with most teachers following safe procedures for maintaining equipment with means ranging from 3.28 to 3.44. However, social responsibility practices, such as refurbishing (2.09) and recycling old computers (2.35), are less common, suggesting room for improvement in sustainable disposal habits.

According to Samajdar (2018) as cited by Sathivelu (2023), proper disposal of ICT waste is vital in order to eliminate the dangerous effects of the toxic components in ICT infrastructures. Appropriate methods of equipment recycling and disposal is important to reduce carbon footprint. Toxic components from ICT products such as Mercury, Lead, Cadmium, Barium and Lithium contaminate the environment and moves through the food chain via root plant translocation system.

Further, result shows that technology-related practices, such as using high-speed optimizers (2.76) and software tools (2.68), show slightly lower ratings, indicating a "good practice" or still a need to further integrate energy-efficient technologies into their routines. As Sathivelu (2023) stated that the conventional way to reduce power usage would be to off the PCs, Router and other ICT infrastructures when not in use but other methods that can be useful in power reduction is substituting desktops to laptops which uses TFT's LCD (Thin film-transistor liquid-crystal display) instead of CRT Monitors. The recent generation of ICT infrastructures are already equipped with energy efficient components which only requires the knowledge on behalf of the end-users.

Table 6. Extent of green ICT practices among teachers in the selected secondary schools.

Indicators	Mean	SD	Interpretation
A. Energy Saving			
1. Reduces energy consumption by decrease use of computers/PC and other ICT equipment,	3.14	0.87	Good Practice

2. Programs the computers automatically to power down to energy saving state without sacrificing its performance,	2.98	0.93	Good Practice
3. Uses lower consumption mode, such as:	3.27	0.79	Good Practice
3.1 Shutdown, hibernation or stand by	3.29	0.86	Very Good Practice
3.2 Monitors into a sleep mode when they are not being used,	3.25	0.83	Good Practice
4. Turns off ICT units/systems when not in use,	3.68	0.63	Very Good Practice
5. Unplugs Laptop/ Computers/ Monitors and Phone Chargers and other ICT equipment when not in use,	3.68	0.65	Very Good Practice
6. Sets printers to duplex and gray scale print by default.	2.69	0.91	Good Practice
B. Social Responsibility			
7. Refurbishes and reuses old computers,	2.09	0.93	Acceptable Practice
8. Properly recycles unwanted computers and other electronic equipment.	2.35	1.04	Good Practice
C. Electrical Care			
9. Sets computers and other ICT equipment/gadget near an electric socket to avoid trailing wires across the floor,	3.36	0.75	Very Good Practice
10. Follows installation and service instructions in the computers and other ICT equipment/gadget guide book and if in doubt consults to experts,	3.41	0.76	Very Good Practice
11. Keeps drinks and plants well away from computers or ICT equipment/gadgets set-up or working area,	3.44	0.81	Very Good Practice
12. Regularly checks all electrical equipment for damage plug or frayed cable.	3.28	0.83	Very Good Practice
D. Technology			
13. Uses computer with high speed optimizer,	2.76	0.96	Good Practice
14. Employs software to provide feedbacks on the operator status and performance.	2.68	0.87	Good Practice
Total Mean & SD	**3.06**	**0.48**	**Good Practice**

Health Challenges Experiences

The overall mean score of 1.60 in Table 7, suggests that in general, the teachers in the study have only slightly experienced health challenges related to ICT use. Moreover, the health conditions most commonly reported as moderately experienced include neck strain (mean = 2.53), back strain (mean = 2.50), and headaches (mean = 2.52). Other conditions such as strain in the arms, wrists, and hands (mean = 2.48) and eye strain (mean = 2.31) are also moderately experienced. It is good to know that more serious conditions like epilepsy, suffocation, or burns from electrocution are only "slightly experienced", indicating that severe health risks are infrequent among the respondents. The symptoms related to strain injuries,

particularly neck pain (mean 2.53 - highly experienced), headache, and eye strain, are more frequently reported, suggesting that prolonged use of ICT equipment may contribute to these health issues. Other conditions like work overload stress, insomnia, and hypertension also fall within the "moderately experienced" category, highlighting that while these symptoms are notable, they are not widespread across the entire respondents.

The teachers in the study generally reported moderate levels of strain injuries associated with ICT use, particularly in the neck, back, and eyes. The frequency of these symptoms suggests that prolonged and repetitive use of ICT tools in teaching may be contributing factors. Neck pain (mean = 2.53) and back pain (mean = 2.50) are often linked to poor posture or improper workstation setup, common issues in environments where technology is used for extended periods. Eye-related issues, such as blurry vision, watery eyes, and dry eyes mean ranging from 2.25 to 2.35, are indicative of visual strain, which is a common result of prolonged screen exposure without proper breaks or screen settings. This can be mitigated with ergonomic interventions, such as screen filters, proper lighting, and frequent breaks. Headaches (mean = 2.52) and work overload stress (mean = 2.44) also suggest that extended hours working on ICT devices, combined with high expectations and stress from workloads, can have cumulative effects on employees' health.

The implications of these findings highlight the need for ergonomic interventions in the workplace, particularly in terms of neck and back strain and eye discomfort. Schools may focus on integrating proper ergonomics into workstations, such as providing adjustable desks, ergonomic chairs, and proper screen positioning to help alleviate strain. Additionally, offering ergonomic training on posture and the importance of regular breaks could reduce the risk of these injuries.

To help teachers deal with eye strain, schools may encourage simple practices like the 20-20-20 rule and ensure personal protective equipment use or devices have blue light filters or anti-glare screens. It might also be helpful to offer blue light-blocking glasses as part of health benefits. Since stress and insomnia are common, schools should consider providing stress management workshops, mindfulness programs, and enough rest time to support teachers' mental well-being. Finally, keeping ICT equipment well-maintained and checking it for safety can help prevent potential hazards, making sure teachers stay healthy and focused in their work.

In a research on office workers in Taiwan highlighted musculoskeletal symptoms and risk factors associated with high computer workloads. They found that shoulder, neck, and upper back discomfort were prevalent, with psychological distress linked to shoulder and upper back pain, and high workload associated with lower back pain. Women reported more shoulder pain than men. The study emphasized the need for interventions addressing both physical and psychological factors to manage musculoskeletal issues effectively (Cho, Hwang, and Cherng, 2012). These symptoms are also felt by the teachers as found in this study.

Erick, Tumoyagae, and Masupe (2022) examined the prevalence and impact of musculoskeletal disorders (MSDs) among teachers. MSDs are a significant occupational health concern, affecting teachers' quality of life and causing economic burdens due to compensation costs and lost income. These disorders reduce productivity through absenteeism, presenteeism, and sick leave. Teachers are particularly at risk for MSDs in areas like the lower back, neck, and upper extremities, due to factors such as the location of schools, carrying heavy loads, prolonged computer use, awkward postures, and psychosocial stressors like poor work environments and job dissatisfaction. On the other hand, strong supervisor support and regular physical exercise can help protect against MSDs.

On the other hand, Akyıldız (2023), digital technologies reduce workplace accidents. However, new risks such as privacy, security, clarity, and responsibility issues emerge as workplaces adopt digital processes.

Table 7. Common health challenges experienced by the teachers for the last twelve months.

Common Health Challenges	Mean	Interpretation
1. Strain Injury	2.38	Moderately experienced
1.1 Eye	2.31	Moderately experienced
1.1.1 blurry vision	2.33	Moderately experienced
1.1.2 watery eyes	2.25	Moderately experienced
1.1.3 dry Eyes	2.35	Moderately experienced
1.2 Legs and feet	2.21	Moderately experienced
1.3 Back	2.50	Moderately experienced
1.4 Neck	2.53	Highly experienced
1.5 Arms, wrist and Hands	2.48	Moderately experienced
2.Tremors	1.69	Slightly experienced
3. Headache	2.52	Highly experienced
4. Work Overload Stress	2.44	Moderately experienced
5. Insomnia	1.86	Moderately experienced
6. Epilepsy/seizure	1.11	Slightly experienced
7. Difficulty breathing/suffocation	1.21	Slightly experienced
8. Ulcer	1.25	Slightly experienced
9. Sprain	1.36	Slightly experienced
10. Burn from electrocution	1.32	Slightly experienced
11. Elevated sugar level/diabetes	1.24	Slightly experienced
12. Hypertension	1.28	Slightly experienced
13. Others (Please specify)	1.10	Slightly experienced
13.1 absent from work due to use of computers	1.15	Slightly experienced
13.2 Hospitalized due to any related risks from using computers	1.04	Slightly experienced
Total Mean	**1.60**	**Slightly experienced**

CONCLUSION

Based on the findings of the study about the green Information and Communication Technology (ICT) practices and health challenges of the teachers in Bagumbayan District, it was concluded that a significant proportion of teachers have not attended ICT training, highlighting a need for increased training opportunities in these areas. As to ICT equipment and usage, personal mobile phones and laptops are the most commonly used ICT equipment among teachers. Daily screen time exposure varies with mobile phones and laptops are used more extensively.

The assessment of Green ICT practices among teachers is commendable (Good practice) being actively engaged in responsible energy consumption, electrical care, and social responsibility related to technology use. While ICT related challenges are generally low, teachers experience moderate levels of neck strain, back strain and headaches, likely due to prolonged ICT equipment use.
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RECOMMENDATIONS

The following recommendations are made considering the research study's findings and conclusions:

1. Teachers who are young in the service of less than 10 years and are active in ICT use are encouraged to get trained not only to maximize ICT in teaching but also to incorporate green technology concepts such as screen time management, turning off ICT units, unplugging equipment when not in use, regular maintenance of school-owned equipment, troubleshooting, safety protocols for shared devices, understanding the environmental impact of ICT, promoting energy-efficient devices and proper recycling.

2. For those teachers who have not attended any training, targeted sessions such as short workshops or online modules may be offered to engage them effectively.

3. Specialized equipment such as tablets, projectors, and televisions is less frequently used due to limited availability so schools may consider increasing investments in up-to-date ICT equipment to ensure all teachers have access to necessary tools.

4. Teachers who rely heavily on mobile phones may be reminded on proper usage, such as adjusting brightness and limiting use before bed.

5. To address the health challenges reported by teachers, they are encouraged to practice regular stretching exercises, take regular breaks and promoted with work-life balance to alleviate work-related stress.

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