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Sustaining Successful ICT Integration in Remote Rural Schools

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ABSTRACT

This paper aims to provide insights into how teachers can sustain ICT integration practices in geographically isolated and disadvantaged areas. A mixed-method case study design was used for the study. Data were collected through interviews, questionnaires, classroom observation, and document examination. Qualitative analysis and descriptive statistics were used to analyse the data. For data validity, triangulation of responses and member checking was carried out. The study identified successful technology integration factors in geographically isolated and disadvantaged schools: a strong community of practice, an adequate support system, and contextual ICT integration practices. It suggests that teachers' pedagogical practices related to ICT toned to undergo a continuous process of review and reflection to ensure that ICT-related practices remain pedagogically effective and relevant to changing needs and contexts. The account of the teachers in this study, focusing on their teaching experiences in a school in a remote, low-income area, creates a paradigm for comparative research on education in challenging contexts. Comparative studies on ICT integration practices in poverty-stricken, post-disaster, and conflict-affected areas, could provide inputs for formulating context-specific policy recommendations that could support successful ICT integration in small rural schools in the Philippines and other developing countries.

Keywords: Contextualized-ICT integration, culturally-relevant instruction, geographically isolated and disadvantaged areas, practice sustainability

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INTRODUCTION

The advent of ICT in the classroom has created a specialized teaching and learning process. It has provided a wide range of experiences that made teaching subject content areas more engaging and relevant

to the students of today's world. Studies have shown that integrating technology in the classrooms contributed significant outcomes and brought significant benefits to learners and teachers alike (Jimoyiannis, 2010; Lu et al., 2015; Wang & Woo, 2007). As the use of ICT becomes widespread, changes in the curriculum and infrastructure were effected to accommodate innovations ushered in by the digital world. As a result, educational reforms have been instituted for 21st-century society. At the same time, the focus is given on the evolving nature of and students' access to knowledge (Jimoyiannis, 2010; Tearle, 2004). Fundamental also to this change is the need to equip the teachers to learn the new set of skills required to use and apply the technology with and re-design learning to work with the technology (Bensalem, 2019; Craciun & Bunoiu, 2015). Therefore, teachers must be adequately trained to effectively and efficiently use ICT in the classroom, design technology-mediated lessons, and keep pace with the fast-advancing technological environment (Aslan & Zhu, 2018; Jimenez, 2005; Lim, 2007).

Many studies showed the positive impact of ICT among students. ICT-mediated instruction offers flexible learning options that contribute to concept deepening and increased academic performance of students. ICT use creates student-centred teaching and an environment that promotes creative and independent learning (Collier-Reed et al., 2013; Gurcay, 2013; Millanes et al., 2018). Whether the schools are in urban or rural settings, students in both areas have shown a positive view of ICT use in education. ICT use promotes a high level of readiness in self-directed learning and establishes interactions among peers and students (Asfar & Zainuddin, 2015; Halili & Sulaiman, 2019).

Introducing innovations in the schools, however, is not without challenges (Livingstone, 2012). Especially for those in remote, rural areas, the process of instituting changes in schools that utilise ICT is faced with various socio-economic, geographical, political, cultural issues (Jimoyiannis, 2010; Lim et al., 2018). Although there has been increased access to computer and Internet technologies, the potential of ICT is yet to be harnessed and recognised to bring about positive changes in the education system. Lack of technological resources, poor Internet connection, and teachers' lack of technological and pedagogical knowledge on the design and implementation of technology-enabled instruction remains to be the significant challenges in bringing ICT into the mainstream of today's educational setting (Aldous, 2008; Aslan & Zhu, 2018; Donnelly et al., 2011; Goktas et al., 2009; Jimenez, 2005; Mtebe et al., 2011; Tearle, 2004).

Numerous research studies suggest that the allocation for ICT infrastructure in disadvantaged areas must be increased to address these issues. ICT courses provided to students must give closer attention to improving their abilities in using the technologies and adapting to the ICT-enabled learning environment (Jimoyiannis, 2010; Lu et al., 2015; Krause et al., 2017).

Developing teachers' positive self-efficacy towards the use of digital media in their classrooms must be facilitated through teacher training on integrating ICT in the curriculum and designing technology-enabled instruction. School administrators must prioritise reaching out to various learning networks for sharing of knowledge, resources, and experiences to enable the adoption of technological innovations in their respective institutions (Aldous, 2008; Jimenez, 2005; Rogers & Twiddle, 2013).

The study intends to contribute to the literature on ICT integration in remote, rural schools. To date, no study was found to have mainly focused on the sustainability of ICT integration in depressed, disadvantaged, and underserved remote villages of the Philippines and have analysed ICT-integration practices of science teachers in these areas. With the challenges posed by the global pandemic caused by Covid19 in Philippine schools, addressing the issues related to ICT use in remote schools now becomes more imperative.

The purpose of this study is to identify factors that could sustain effective and efficient integration of technologies in the classroom, even in geographically isolated and disadvantaged areas (GIDA). The research focused on describing the science teachers' experiences with ICT integration and gaining insights to design teacher education. In addition, establish an effective system for acquiring resources and formulate strategies to improve access to ICT resources and enhance technical knowledge and skills for integrating technology in GIDA.

Specifically, the following are the research objectives:

1. To describe ICT integration practices of science teachers in a small rural school in the Philippines.
2. To determine the challenges teachers encountered when they used the technologies and how they overcame them.
3. To identify facilitating factors to sustain successful integration of technology in geographically isolated and disadvantaged schools.

METHODS

The study applied a mixed-method case study design to focus the inquiry on the teaching strategies employed by the teachers in teaching science concepts through the use of ICT. It employed an exploratory sequential approach. The researcher first explored the qualitative and quantitative data in the second phase of data analysis (Creswell, 2014). Yin (2003) mentioned that the case study is an excellent methodological framework to perform mixed-method research in the social sciences. This study collected qualitative data from interviews, open-ended questions shared with the principals and teachers, and document review. The questionnaire and classroom observation checklist, on the other hand, generated the quantitative data for the study.

The study examined the teaching strategies of science teachers teaching in GIDA in the Philippines. GIDA refers to communities, physically and socio-economically separated from the mainstream

society and characterised by isolation due to distance, weather conditions, and transportation difficulties (Department of Health, n.d.). It also identified the challenges teachers encountered when they used the technologies and how they overcame them. Both qualitative and quantitative data were used to identify facilitating factors that could promote the sustainability of practices.

The researcher obtained permission from the Schools Division superintendent to conduct the research in the school identified for the study. After the permission was granted, the researcher coordinated with the school principal and teachers to schedule and program research activities. The study was conducted within the school year 2018-2019. The researcher was allowed to conduct class observation, administer test instruments, and interview the principal and teachers from August 2018 to April 2019. Each classroom has a class size of 35. It was noted that the number of students was a challenge in conducting the technology-based activities because there were not enough computers for the students to use. Furthermore, simultaneously accessing the Internet resulted to a slow connection.

The school is located in a landlocked town and is 73 kilometres away from the capital city of the province. The town is a fifth class municipality. It earns an average income of 1,000,000 Philippine Pesos (approximately US$19,775) or more, but not more than 3,000,000 Philippine Pesos (approximately US$59,320) per year. The school site can be accessed by tricycle, a three-wheeled vehicle, or motorcycle. However, due to the school's remoteness, most teachers, including the principal, travel to school by motorcycles. The school, established in 1994, is managed by the country's Department of Education (DepEd). It is headed by a principal, with a headteacher assisting her in managing the school. It has 12 teachers, where eight are teaching in the Junior High School (Grades 7 to 10), while four are in Senior High School (Grades 11 to 12). As of the time of research, in 2018-2019, 208 students were enrolled in Junior High School level, and 46 in the Senior High School. The majority of the students (70%) belong to a cultural community called Isneg. In contrast, the rest of the students belong to an ethnolinguistic group called Ilocanos. Families of the students are recipients of the Pantawid Pamilyang Pilipino Program (4Ps), a social development program of the Philippine government that provides conditional cash grants to families belonging to the lowest economic bracket. 4Ps helps improve the health, nutrition, and education of children age 0-18. Details of the 4Ps program are provided in the Philippine Official Gazette (n.d.).

Science teaching at the Junior High School level was chosen because of the following factors:

1. It follows a uniform science curriculum unlike in Senior High School, where its academic strand has specific tracks;
2. The curriculum is implemented in spiral progression, an approach where concepts introduced in grade

school are re-taught in succeeding years with increasing complexity and sophistication to ensure concept mastery after each level; and

3. Teachers have to teach a science discipline that is not his or her major field.

With the recent implementation of the K-12 program in the Philippines, science teachers are expected to teach science subjects other than their major program in their pre-service education. For example, a teacher whose major is Chemistry also teaches Physics, Biology, and Earth Science**.**

The key participants in this study were the three science teachers. They were coded for analysis as Teacher A, Teacher B, and Teacher C. Teacher A is 24 years old and a new teacher. She is teaching science subjects in three grade levels, Grades 7 to 9. She has a Bachelor in Secondary Education degree and master's degree. Teacher B is a 43-year old male who has been teaching science for 21 years, where five years were in the current school. He is an ICT teacher and a science teacher teaching Junior High School (Grades 7, 9-10) and Senior High School (Grades 11-12) students. He is a graduate of the General Education course and has master's degree. Teacher B started teaching in a city school in the National Capital Region of the country. On the other hand, Teacher C is a 34-year old female teacher teaching three subjects to Grades 7 and 10 students: Science; Technology and Livelihood Education; and *Edukasyon sa Pagpapakatao* (Values Education). She is a graduate of Bachelor of Secondary Education major in Biology and has master's degree. She is also the school's headteacher. She assists the principal in managing and monitoring the teaching-learning process in the school.

Data were collected through open-ended interviews with the teachers, a classroom observation form that elicited students' attitudes towards ICT-integrated learning activities, and attitudes towards knowledge and experiences gained after the teacher implementation of the activities, and a questionnaire on ICT use and integration practices used in Bazzer's (2016) study. The following documents were also examined: The school's improvement plan helped to determine the extent to which ICT was integrated into the whole school environment; the teacher's learning plan, used during the lesson observation, provided information on how ICT is integrated into the delivery of lessons, and four local news releases with accompanying photographs that helped to the understand the geographical and cultural landscape of the school. A form adopted from the open access publication UNESCO (2016) was used for the lesson observation. Permissions was sought from and granted from the authors of the instruments used. Follow-up interviews were conducted via the messaging app Facebook Messenger to deepen understanding of the responses to the questionnaire and face-to-face interviews. The number of chat messages analysed in the study totalled 31, broken down as follows: Teacher A, 6; Teacher B, 14; and Teacher C, 11.

The researcher observed one class. The observation was held in the regular classroom. The lesson was on the Nervous System, which, based on the learning plan, was one of the topics under Module 1 (Coordinated Functions of the Nervous, Endocrine, and Reproductive System) for the Third Quarter. The observation form recorded the event's encoding, which includes the sequence of instructional activities, ICT and non-ICT tools used, activity guidelines, and the students' attitudes towards the learning activities that utilised ICT.

Data were analysed using descriptive statistics and qualitative analysis. Quantitative values generated from questionnaire responses were normalised for aggregation. It was done to make the measurements comparable, considering the differences in the underlying property or objectives. The arithmetic mean was used as a statistical tool for aggregation due to the small data involved, and there were no extreme values. The evaluation and scoring of the items followed the scale shown in Appendix A. The participant's responses to the open-ended questions in the questionnaire, and interview data were transcribed and a code was assigned to each 'case' teacher. As the analysis was ongoing, themes were identified and continuously reviewed for overlap and completeness. For data validity, triangulation of teachers' responses during interviews and the online survey results on ICT utilisation and competencies was done. Results of which were used to build a coherent justification for the themes established during the analysis. Member checking was conducted through chat messaging to deepen understanding of the teachers' responses during data processing and determine the accuracy of the qualitative findings.

RESULTS AND DISCUSSIONS

The study's findings were derived from the teachers' responses from interviews and questionnaires, notes from classroom observation, chat messages and relevant data in the school improvement plan. The results informed the author of the pedagogical practices of teachers using ICT in GIDA, the challenges associated with implementing of those practices and facilitating factors that could sustain successful ICT integration in said areas.

Pedagogical Practices using ICT

Data from interviews and questionnaires, notes from classroom observation, and relevant data in the school improvement plan showed teachers' pedagogical practices in using ICT. The teachers used a mix of traditional and digital teaching strategies and implemented indigenised ICT-mediated instruction.

A Mix of Traditional and Digital Strategies. Teacher A mentioned that adopting technologies in teaching was not new to her. "I start *(sic)* using ICT in my teaching since 2014, my first year in service". She started with technologies like "Ppt , video clips, swf files", which she utilised up to the research time. She used

them so her "students can understand the lesson well". She said she always considers the availability of materials appropriate to the topic and an Internet connection when integrating ICT in teaching science.

When she was hired as a science teacher in 2014, she implemented activities to develop higher-order thinking skills. She used digital technologies but also traditional strategies like "role-playing, puzzle, and quiz". She said students in her classroom were heterogeneously grouped, so she wanted to involve every child, even those who had difficulty catching up with the lesson. Teacher A described her strategies as mixed:

> *... ginagawa ko kapag discussion, ppt or video clips pero pag nasa transfer of learning, na dun ko po ginagamit ung mga nabanggit ko po." (In discussing the lesson, I use ppt or video clips, but when it comes to transferring of learning, that's when I use the traditional strategies I mentioned earlier).*

Teacher B, on the other hand, had experienced using different types of technologies. From software running in DOS (Disk Operating System) in the 1990s up to this time when technologies have become more efficient and ubiquitous. He started using productivity tools to perform administrative tasks, and used ICT for research, robotics, and presentation software to present his lessons. His teaching strategies further evolved when he engaged his students in interactive activities that maximised the use of technology in lesson implementation starting in 2012.

Teacher B shared that he used ICT and various approaches like guided inquiry, reflective journals, brainstorming, open-ended questions, complemented with face-to-face discussion. Through these, students deepened their understanding of science concepts and applied them to real-world situations. He said,

> *Learners today are technology babies, they grew up with technologies, and I think this is a great tool for learning. Integrating technology into learning is like bringing learning to their comfort zones.*

Teacher C had explored digital technology resources such as SIM (Strategic Intervention Material), presentation software, models, and videos in teaching science concepts. Like Teacher B, her adoption and use of ICT tools progressed as her teaching experience deepened. From her qualitative responses during an interview and online questionnaire, it can be deduced that Teacher C used digital technology resources. She helps her students understand scientific concepts and relate them to real-life situations.

She pointed out that teaching science could be made more meaningful through simulations, "especially in subjects like atoms, space exploration and others that cannot be done with real experiments". However, she indicated that she did not use digital technologies in teaching science

lessons most of the time. However, she made sure that her teaching strategies would enable her students to acquire 21st-century skills. For example, to develop critical thinking skills, she required her students to create memes with "hugot" lines to measure their mastery of the science concepts. "Hugot" lines are words with deep personal meaning or emotional undertones used by most Filipinos to express their feelings subtly. The memes are then posted on Facebook for concept sharing and assessment. Furthermore, to promote high level thinking skills, she has also scheduled performances where students prepare the script and production for "madulang sabayang pagbigkas" (theatrical spoken choir), write and recite poetry, compose songs, choreograph a dance, tell stories, conduct interactive lab activities and manipulatives, and conduct interviews. These activities enhanced the critical thinking and creativity of students, she said. In addition, Teacher C's teaching strategies were affirmed in Craciun and Bunoiu's (2015) study, which indicates that creativity serves as a foundation of progress and innovation in science. The authors suggested that teachers must implement activities that will facilitate divergent thinking, imagination, communication, and collaboration skills to foster creativity.

The three 'case' teachers combined traditional and digital teaching strategies to deepen concept understanding, develop critical thinking, and provide authentic learning experiences. Through this process, they enhanced their teaching skills and evolved new strategies to enrich learning experiences. Rogers and Twiddle (2013) mentioned that the adoption of innovation is successful when ICT activities complement non-ICT activities to facilitate science learning objectives. Steiner and Mendelovitch (2017) pointed out that science teachers need to adopt a pedagogical paradigm that promotes the learner as an active participant in knowledge construction, with the teacher assuming the role of supporter and guide in the teaching-learning process.

The use of traditional and digital technologies in specific instructional procedures showed that the teachers perceived ICT as helpful in providing meaningful learning experiences. Rogers' Diffusion of Innovation theory (DOI) poses that teachers adopt innovation when it is seen as a tool to provide helpful learning experiences and consistent with the existing values, past experiences, and needs of the potential adopters (Sahin, 2006).

The findings complemented their rating on the extent of ICT utilization (Table 1). Table 1 shows that the school has high ICT utilisation with a mean rating of 83.3. Furthermore, Teacher A and Teacher C utilised ICT "Always", while Teacher B mentioned using ICT "Often". With these results, one can construe that the school recognises the potential of ICT in the classroom.

The findings are found to be in consonance with their responses in Table 2 which showed the teachers' "High" competencies in using ICT tools in the classroom (with a general mean of 84.22).

Table 1
Teachers' ICT utilisation

ICT Utilisation	Normalised value (%)	Qualitative Equivalent	Normalised value (%)	Qualitative Equivalent	Normalised value (%)	Qualitative Equivalent
	Teacher A		Teacher B		Teacher C	
Mean	93.33	Always	76.66	Often	95	Always
	88.33	Always				

Table 2
Teachers' competencies in using ICT tools

ICT Competencies	Normalized value (%)	Qualitative Equivalent	Normalized value (%)	Qualitative Equivalent	Normalized value (%)	Qualitative Equivalent
	Teacher A		Teacher B		Teacher C	
Computer operations	72	High	100	Very High	100	Very High
Productivity tools	70	High	98.33	Very High	100	Very High
Internet and network applications	65.71	High	80	High	100	Very High
Legal aspects of technology use	73.33	High	80	High	80	High
Ethical use of technology	60	Average	84	Very High	100	Very High
Mean	68.20	High	88.47	Very High	96	Very High
General Mean	84.22	Very High				

Teacher A rated herself "High" in almost all competencies. The two other science teachers rated most of their ICT competencies "High" and "Very High". Teacher A has been teaching for four years, compared to Teacher B and Teacher C, who have teaching experience of 21 years and 11 years, respectively. This could indicate that teaching experience could be a factor in the teachers' perceived self-efficacy on using ICT in teaching. Knowledge and skills of the use of ICT are necessary. However, it is also essential that teachers have the confidence to integrate technology in their teaching. Buabeng-Andoh (2012) and Taimalu and Luik (2019) mentioned that older teachers who have "rich teaching experience, classroom management and competent in using computers could easily integrate ICT into their teaching".

In terms of research competency, the teachers' ratings ranged from "Low" to "High" (Table 3. Except for Teacher C, who rated herself "High", a lack of research competency was noted on the responses.

It can be noted that Teachers B and C gave themselves a very high rating when exploring new technologies. On the other hand, Teacher A rated "Average" for her research-related activities competency. At the same time, Teacher B gave himself a "Low" rating. His "Low" rating in

Table 3
Teachers' research-related competencies

ICT Competencies	Normalized value (%)	Qualitative Equivalent	Normalized value (%)	Qualitative Equivalent	Normalized value (%)	Qualitative Equivalent
	Teacher A		Teacher B		Teacher C	
Exploring new technologies	60	Average	80	High	93.33	Very High
Research on the use of technology	60	Average	40	Low	73	High
Sharing of expertise	55	Average	40	Low	60	Average
Mean	58.33	Average	53.33	Average	75.44	High
General Mean	62.37	High				

competencies related to research validated his response. He had not done any research to test the effectiveness of the technological tools he used in his classes. Teacher A also admitted that she had not done any ICT-related research or any research at all.

These findings indicate a need to develop a culture of research in the school to enrich their academic experiences. A study conducted by Ulla et al. (2017), revealed that lack of research knowledge and skills, heavy teaching loads, and lack of financial support from the school constrained teachers from developing their research skills. Thus, the study could also explain the teachers' responses regarding their competency related to sharing expertise in academic conferences. With the dearth of research initiated by teachers, particularly in remote rural areas, presenting in academic events like conferences and forums would not be a priority as expected. In this study, based on the questionnaire, Teacher A and Teacher C rated themselves "Average". In contrast, Teacher B rated himself "Low" in this particular ICT competency.

Indigenised Delivery of Instruction. In a school where majority of students belong to a cultural community, teachers believed that it is important to take into account their culture and socio-economic situation when using ICT in the classroom. Teacher B, during an interview, expressed that using technologies in the classroom must consider the learning abilities and the socio-cultural background of the learners. He mentioned that he wanted his students "to blend with other communities" and develop competencies at par with other youths. In their school, he said, they "develop students to be competitive not only in the community they belong but also globally without sacrificing the culture of the community they belong *(sic)*". He rated his competency "High" in designing instruction that addresses diversity.

On the other hand, Teacher C commented that their school has already transcended cultural barriers in integrating ICT. She emphasised that they "do not have a cultural barrier because our students have good and positive acceptance of them. We have programs that strengthen respect and cultural

participation. Moreover, in using ICT, the benefit it could give to the community is the most important." She added that their school has programs that preserve the culture of the community where most of their students belong. She said that one of her teaching strategies is to prepare instructional materials that reflect the students' cultural backgrounds. This practice was highlighted in the school's improvement plan and local news releases examined by the author. Under its project known as Inculcating the Significance of Noble Ethnic Group, which has the acronym ISNEG, the school reported integrating the Isneg's culture in the curriculum during the year. At the time of research, they were developing ICT-based materials that teachers and students can use. These include *Picture It,* documentation of significant people, events, materials, and traditions of the Isnegs, and the crafting of the Yapayao (local language of the cultural community) orthography for classroom instruction. These initiatives were done in partnership with the community elders, local government, and a non-government group called Bayani (Hero) Club.

Their cognisance to address diversity in the classroom is reflected in their responses in Table 4, where a general mean of 74.2 ("High" rating) was recorded.

Based on the results, Teacher A rated herself "Average" in all tasks designing ICT-enabled lessons that address learning, social, and cultural diversity. Teacher C has the highest rating of 91.7 or Very High. Finally, Teacher B got a High rating with a value of 71.1. The result shows that the three teachers in particular, and the school in general, are giving high value on addressing the needs of their diverse learners.

Challenges in ICT Integration

Challenges in ICT integration were likewise reflected from the questionnaire and follow-up interviews through chat messaging and

Table 4
Teachers' competencies in addressing learner diversity

ICT Utilization and Competencies	Normalized value (%)	Qualitative Equivalent	Normalized value (%)	Qualitative Equivalent	Normalized value (%)	Qualitative Equivalent
	Teacher A		Teacher B		Teacher C	
Promotion of sound learning environment	60	Average	73.33	High	100	Very High
Learning, Social and Cultural Diversity	60	Average	70	High	95	Very High
Addressing diversity of learners	60	Average	70	High	80	High
Mean	60	Average	71.1	High	91.7	Very High
General Mean	74.2	High				

notes from classroom observation. These are as follows:

1. lack of time to prepare ICT-based materials;
2. lack of technical infrastructure in the school;
3. lack of teaching methods or strategies for ICT use; and
4. absence of a reward system to encourage ICT use.

The same set of data emerged the measures that they employed to overcome these challenges, as follows:

1. forming a community of practice for collaborative learning;
2. maintaining a solid support system with stakeholders; and
3. a positive attitude towards the use of technology.

Finding adequate time to prepare ICT-based materials is a significant challenge for all the three 'case' teachers. For example, Teacher A may be teaching science subjects only. However, she said that there is too much workload that consumed even her scheduled breaks between classes. "Lack of time to prepare because as a teacher we have many things to do if we have our vacant [time]", she explained. On the other hand, Teacher B is also a division ICT trainer, which means that he not only trains his peers in his school but also provides training to teachers in other schools of the province. Finally, Teacher C is the schools' headteacher. Other than teaching three subjects in two grade levels, she performs other tasks, including providing management support to the school, monitoring the teaching-learning process, and establishing and maintaining strong linkage with stakeholders. This finding is subscribed to by Aslan and Zhu (2018). They stated that teachers could not effectively integrate ICT because they have many content areas to cover and examinations to prepare. Goktas et al. (2009) also found out that too much workload is one of the barriers to effective ICT integration in pre-service teacher education programs.

Another challenge they mentioned is the lack of technical infrastructure in the school. Again, the researcher was able to see this problem during a classroom observation. Teacher B introduced Internet-based instructional material for the students. The students were told to access the online material using the school's pocket Wi-Fi and participate in the activity. However, due to poor connectivity, access to the online site lagged and consumed so much time that caused frustration and boredom to the students. The teacher had to request some of the students to log out to improve the connection to the site. According to Teacher C, they could not subscribe to existing Internet providers in the province due to their school's location. They had to use mobile phone data or the pocket Wi-Fi the school purchased to access the Internet. She said the teachers spent their own money to pay for the mobile data used for instructional purposes.

Teachers B and C added to the challenges the lack of teaching methods for ICT use. Teacher B said that he has adequate knowledge of ICT-mediated teaching strategies, which he acquired from when he

started teaching. However, he clarified in a chat message that he had his colleagues in mind when he mentioned the inadequacy of ICT-based teaching methods as a challenge on ICT integration:

> *"Some of my co teachers still don't embrace the change. kahit kc mga millenials ang karamihan sa kanila, iba pa rin kc pag apps na ang ginamit sa pagtuturo, they find it time consuming ang paggawa, kc bibihira ang materials pag filipino, ap ang subjects. Di po kc tulad ng science, marami ang ready materials." (Some of my co-teachers still don't embrace the change, though most of them are millennials. Having their own apps for instruction makes a lot of difference. Yet, they found developing their own apps time-consuming. [I am particularly concerned about developing apps] for Filipino [language] and AP [Araling Panlipunan or Social Studies] subjects for which (technological resources) are few. Unlike science, there are already plenty of ready [ICT-based instructional] materials).*

Teachers B and C also cited the absence of reward systems for encouraging ICT use. The absence, they said, contributed to the lack of interest of some teachers in using ICT in their teaching. Teachers B and C both hold the administrative load. So it can be presumed that they are concerned about motivating their co-teachers to integrate technology in their respective classrooms. Sahin (2006), in his review of the DOI theory, cited that incentives may be used to increase the rate of adoption of innovations by the teachers. Incentives, he said, are part of the cost and motivation factors under the relative advantage attribute. Lim (2007) subscribed to this when he recommended setting up a mechanism to provide incentives to use ICT. He mentioned that this practice would develop among teachers' positive attitudes towards ICT.

The teachers, however, explained that they were able to overcome these challenges through the sense of community they developed not only in their school but also with other schools of the province. Teacher B said he coordinated with "fellow teachers and other stakeholders on resolving issues such as lack of Internet connection and inadequate knowledge to integrate technology in the classroom". He also assisted his peers in acquiring ICT competencies during their Learning Action Cell (LAC) sessions to increase their interest in ICT integration and provide continuous support to teachers using various Internet applications. LAC sessions are held every Thursday where teachers and staff work together to solve problems related to curriculum implementation in the school. Teacher A shared that attending the LAC session was a great help. It taught her how to motivate students to participate in classroom activities actively and efficiently assess their performance. "... alam nmn po natin na ung mga bata mas gusto nila ung may games

ka gya ng hot potatoes, swf Files, kahoot. Nakakatulong din po ito sa amon lalo na pag exam ang zipgrade (We all know that children prefer games like hot potatoes, swf files, kahoot. Zipgrade also is helpful to us especially during examination)".

Teacher C further shared that they were able to overcome the challenges despite the remoteness of their school because of the 'effective' support system they maintain with local and international institutions. "With internal and external shareholders willing to help, all challenges are/were slowly addressed," she said. She attributed this to her school close collaboration with local government, department of education, and international organisations. They have facilitated the professional development for teachers and staff and the acquisition of ICT resources for the school. She also said they had established a link with a higher education institution in Japan for funding and professional development.

There is an indication that the school highly recognises the potential of ICT in the implementation of its curriculum. Teacher A pointed this out when she acknowledged the importance of integrating technology for the 21st-century classroom "especially this time so that we can adapt to the changes in our environment". Teacher C affirmed her response, who said that ICT integration could help meet "the demands of the curriculum in this modern age". Teacher B saw technology as helpful in "easing the burdens of teaching, from recording assessment of students, up to learning materials preparation".

Based on the above responses, a positive attitude toward using ICT in the classroom could have helped the school overcome the challenges. They did not regard the lack of technological resources, inadequate teaching strategies, or absence of the reward system as hindrances. Instead, they used their resources like cellular phones, laptop computers in developing their digital instructional materials and mobile data to connect to the Internet. They also took the initiative to participate in teacher training programs to improve their competencies in using ICT. One of the teachers called it "sariling sikap" (own efforts). This positive attitude towards ICT use subscribes to the research findings of Jimenez (2005). He included a positive predisposition towards technological innovations as the conditions that rural schools need to sustain classrooms ICT integration.

Factors to Sustain Successful ICT Integration Practices in GIDA

The study on teachers' pedagogical practices for ICT use, the challenges and solutions, and the geographical and cultural landscapes surrounding the school's learning environment gave insights on promoting sustainability of successful ICT integration practices in geographically isolated disadvantaged areas or GIDA. The facilitating factors are a strong community of practice, an adequate support system, and contextualised ICT integration.

A Strong Community of Practice. The regular holding of the LAC session strengthened the sense of community among the school leaders, teachers, and staff. Held every Thursday, all school community members were allowed to work together in developing ICT-based instructional materials.

> *… kaya nga po ngayon every LAC namin, pakunti kunti we are compiling our materials. (That is why every LAC [session], we are gradually compiling our materials).* (Teacher B)

> *...sa pamamangitan po ng LAC time po namin at my alloted time po for preparation of IM po" (During LAC time, we are allotted time for preparation of IM [instructional materials])* (Teacher C)

The materials were also shared with other schools in the province. Teacher B said they look forward to having these materials included in the depository of instructional materials that all teachers in the Division can download and use.

> *... even in the division ung mga pinapagawa namin (those we are developing) every training, naishashare namin (we can share) to other teachers in the division. And sooner, the division will be launching the division LRMDS here every teacher can download ready-made materials. Un na rin po ang target namin sa school (that's also the target of our school), mam".* (Teacher B)

LRMDS or Learning Resources Management and Development System serves as a portal of learning, teaching, and professional development resources for DepEd teachers.

This sense of community was also underlined by Teachers B and C's concern to help their colleagues overcome the challenges of insufficient knowledge about how to implement ICT-mediated instruction and the lack of a reward system to encourage ICT in teaching. Their commitment to supporting them in developing their competencies in integrating technologies indicates that sustaining successful ICT integration in small rural schools can be achieved if they consistently "scaffold each other in their professional development" (Lim, 2007).

Effective Support System. Interviews with teachers and digital photographs highlighted the school's different activities further to strengthen its linkages with local and international institutions. The school regularly tapped the elders of the community for activities that will keep the students aware of and at the same time instil pride in their cultural roots. The photographs featured the IP (Indigenous People) day celebration where community elders wearing traditional costumes were invited to recount the history and teach their traditions.

Teacher C reiterated that they had maintained a strong relationship with the

town and provincial governments, which they could always count on for funding and the professional development of their teachers. She added that they have the full support of the local office of DepEd in their province, which always involved them in ICT-related activities. Furthermore, at the time of the research, the school had just forged a partnership with an academic institution in Japan. The institution is committed to assisting them in improving the teaching strategies of their teachers through ICT use.

Contextualised ICT Integration Practices. Teacher A is a member of the Isneg community. The two other teachers belong to the ethnolinguistic group Ilocanos. Teacher A said being a community member enabled her to give examples "related to their culture that students could easily relate to".

Teacher B admitted that integrating culture in teaching science concepts is challenging. However, he said they could integrate culture in other classroom tasks.

> *... every end of the quarter, we give students a group project showcasing what they have learned from the lessons. It could be video clips, a drama, brochures, a symposium, etc. That will be presented in the community. So most of the time, they use their dialect for communicating. (Teacher B)*

Teacher C confirmed that their instructional materials are being contextualised, localised, and indigenised. The local culture is integrated into any appropriate context.

> *... wala pong specific lesson po kc pinapasok po namin sa any applicable po...may contextualization, localization n indigenization po kmi sa IMs, discussion, performance tasks at test questions po na nasasama culture and local events and situations po (There is no specific lesson that we integrate the culture, as long as its applicable, we include it... we have contextualisation, localisation, and indigenisation for our IMs [instructional materials], discussion, performance tasks, and test questions, where we integrate culture, local events, and situations). (Teacher C)*

The teachers used technological tools to advance the culture, practices, indigenous knowledge, and learning system of the community. They kept their learners engaged by helping them relate content to their own cultural identity. It highlights the delivery of instruction that applies indigenised practices in classroom activities and instructional materials utilisation.

Limitations of the Study

The study has a small number of teachers. It is suggested that more rural schools located in remote areas be used in future research to gain a broader picture of this topic. Future research may also focus on other subject content areas.

CONCLUSION

Given socio-economic, cultural, and geographical factors, the challenges in integrating ICT in remote rural schools may be more significant. However, meeting with these challenges and sustaining teaching strategies that use ICT requires a strong sense of community to promote collaborative learning, building new and expanding existing relationships with national and international partners to provide resources, and contextualisation ICT integration to make learning relevant and exciting.

Successful ICT practices can be sustained in rural schools when teachers have a positive attitude towards technological innovations. This positive predisposition translates to a deep commitment to providing meaningful learning experiences despite the challenges associated with integrating technology in geographically isolated and disadvantaged areas.

Thus, the teachers' pedagogical practices related to ICT must be subjected to a continuing process of review and reflection. Then when necessary, changes or adjustments must be undertaken to make such ICT-related practices remain pedagogically potent and relevant to changing needs and contexts.

IMPLICATIONS FOR FUTURE RESEARCH

The findings of this study could aid school administrators and policymakers set up policies and programs. That would help improve access to ICT resources and upgrade teachers' technological knowledge and skills in integrating technology for schools in GIDA. In addition, the account of the teachers, which focused on their teaching experiences in a school located in a low-income remote area, provides perspectives for comparative research within the purview of education under challenging contexts. Comparative studies on ICT integration practices in poverty-stricken, post-disaster, and conflict-affected areas could generate inputs for formulating contextually appropriate policy directions to sustain successful ICT integration in small rural schools of the Philippines and other developing countries. However, this study recognises further limitations in the timescales. In the light of the rapid change of pace involved in technology applications in education, how long should this type of study be observed before technology integration becomes contextually relevant? It is yet another question that future research will have to address.

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APPENDIX

Appendix A
Evaluation and scoring scale

Unit Weight	Normalized value interval (%)	Verbal interpretation	
		ICT Utilization	ICT Competency
5	81-100	Always	Very High
4	61-80	Often	High
3	41-60	Sometimes	Average
2	21-40	Rarely	Low
1	1-20	Never	Very Low