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Availability of Technological Learning Applications and Tools, Science Teachers' Levels of Use of Online Teaching, and Their Stages of Concerns

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ABSTRACT

Using descriptive-correlational research design, this study determined the relationship between the availability of technological learning applications and tools, and science teachers' levels of use of online teaching, and their stages of concern. It was conducted at the Schools Division of Laoag City involving all elementary science teachers who are teaching online for the SY 2021-2022. Hence, the purposive sampling technique was used to determine the teachers involved in the study. Findings revealed that the respondents are young adult. The majority of them are female. Most of them are teaching Science for less than five years. Their mean years of teaching Science is 9.44. Majority of them have masters' units and they have attended trainings and seminars related to online teaching. The respondents have the availability of technological learning applications and tools in online teaching. The teachers' level of use of online teaching falls at Level V (Integration Stage) while the teachers' stages of concern fall at Stage 0 (Awareness). Findings also revealed that only the teachers' number of years teaching in Science is significantly related to their level of use of online teaching.

INTRODUCTION

Science has been linked to innovation and has resulted in viable technologies resulting in the modern world's sustainable development. It is convenient to assert that science, technology, and innovation are the pillars of sustainable development in an industrialized world and contribute significantly to education. Education lays the groundwork for advancements in science and technology. In the Philippines, science education emphasizes the importance of science and technology in daily life. It integrates science and technology into all facets of life, including social, economic, personal, and ethical. The science curriculum emphasizes the importance of a strong connection between science and technology (K to 12 Science Curriculum Guide, 2016). The emergence of technology has yielded transformations of new approaches and pedagogies in science education (Namoco, 2020). Facilitating science learning does not have to take place in a classroom setting with the traditional method any longer, as it has transformed (Ali *et al.*, 2019).

Recently, the educational landscape all over the world has changed due to the COVID-19 pandemic. Gayon (2021) cited that the educational sector is adversely affected by the current global health crisis. In return, this unfortunate situation has brought a shift in the education system (Ardiasih, 2021). Thus, resulting in the closure of schools and universities to mitigate the spread of the virus (Tuguic, 2021). Amid the public health emergency created by the COVID-19 pandemic, the Department of Education (DepEd) is committed to ensuring the uninterrupted delivery of basic education services to its learners and the community. In accordance with DepEd Order No. 012, series of 2020, Adoption of the Basic Education Standards in 2020 School Year 2020-2021

Education Learning Continuity Plan (BE-LCP) in the light of the COVID-19 Public Health Emergency, DepEd has employed multiple learning delivery modalities (LDMs) to ensure the continued provision of instruction, while safeguarding the health and safety of its learners. This has been accomplished through blended learning, distance learning, or a combination of the two.

Furthermore, the DepEd reaffirms its commitment to providing excellent, accessible, relevant, and liberating basic education services in the Philippines based on the Sulong EduKalidad framework, which keeps working to develop comprehensive Filipino learners with 21st-century capabilities. DepEd Secretary Leonor Briones mentioned that civilization advances only through innovation and innovation must start in the basic education level. With this, the DepEd released the Most Essential Learning Competencies (MELCs) for use by field implementers or teachers nationwide during SY 2020-2021 (DepEd, 2020).

Even before COVID-19 wreaked havoc in the country, the DepEd has recognized the growing role of technology in education. The pandemic condition has intensified the growing desire for educational change brought about by rapid technology advancement (Ocampo & Solina, 2021). Considering the current educational setting, the more it is imperative and practical to take advantage of technology. The use of technology in 3 teaching modalities, with the use of the internet to deliver the lesson to learners are considered to address these concerns (Ocampo & Solina, 2021). As a result, one of the first pedagogical methodologies to be presented is online teaching, which is now used by teachers all over the world (Manalo & Venavides, 2021). Online teaching is becoming the norm (Callo & Yazon, 2020). With unpredictable prospects, it

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is clear that the nation requires adaptable and resilient educational systems (Ali, 2020). For science teachers, online teaching is becoming especially important (Clark & Rowe, 2019). Online teaching in Science has the potential to significantly improve science literacy and the acquisition of science process skills amidst pandemic. It can assist students improve their scientific literacy, while allowing them to obtain ICT skills. Because of the benefits afforded by modern technology, online teaching in Science can surely assist students in obtaining a strong comprehension of scientific principles. Online teaching is almost certain to take up a significant portion in science education (Sutton, 2020).

Given the unexpected nature of online teaching during this pandemic, teachers have several concerns on its implementation such as a lack of resources or technical difficulties. Thus, the disparate nature of online teaching and a perceived lack of information about effective pedagogy, combined with a dearth of role models demonstrating successful use, are also identified as concerns in the implementation of online teaching in Science (Twidle *et al.*, 2020). This condition is possible for any science teacher experiencing difficulties, as the current challenge is not only focused on the implementation of online learning, but also in the implementation of hands-on/minds-on activities in science education (Wisanti *et al.*, 2021). Throughout the pandemic, science teachers are challenged to conduct classes online. Science teachers face a unique set of challenges because they need to organize instruction that encompasses not only theoretical knowledge, but also practical skills, necessitating the transfer of experiments and laboratory activities to an online environment (Babinčáková & Bernard, 2020).

The abovementioned reasons motivated the researchers to conduct the present study which is focused on the availability of technological learning applications and tools, science teachers' levels of use of online teaching, and their stages of concerns in online teaching. Also, the study tried to determine the following: 1) socio-demographic characteristics of teachers and the relationship to the availability of technological learning applications and tools, levels of use of online teaching, and stages of concerns in online teaching; 2) availability of technological learning applications and tools used by the teachers and the relationship to levels of use of online teaching and stages of concern in online teaching; and 3) teachers' levels of use of online teaching and the relationship to stages of concern in online teaching.

LITERATURE REVIEW

Science education aims to develop scientific literacy in students, resulting in informed and engaged citizens capable of making judgments and decisions about the applications of scientific knowledge in areas such as social, health, and the environment. The science curriculum emphasizes the importance of science and technology in daily life. It integrates science and technology into all facets of life, including social, economic, personal,

and ethical. The science curriculum emphasizes the importance of a strong connection between science and technology (K to 12 Science Curriculum Guide, 2016).

The K to 12 science curriculum equips students with a repertoire of essential skills for success in the workplace and in a knowledge-based society. It envisions the development of scientifically, technologically, and environmentally literate and productive members of society who are capable of solving complex problems, acting as responsible stewards of nature, being innovative and creative citizens, making informed decisions, and communicating effectively.

In the pursuit of knowledge, teachers play a crucial role in shaping the quality of citizens, as emphasized by Magnaye (2022). The education provided by teachers significantly influences the development of individuals and ultimately impacts society. Teachers have the responsibility of imparting knowledge, skills, and values to their students, equipping them with the necessary tools to become informed, responsible, and active members of society.

Calzada and Antonio (2023) outlined the long-standing issues in the education sector have remained unaddressed despite the implementation of the K to 12 curriculum. Problems such as the shortage of classrooms, textbooks, seating, and toilets in public schools persist (Navarro, 2022). Teachers continue to face overwhelming teaching loads (Esguera, 2018), challenges in following the spiral progression approach in teaching (Dunton & Co, 2019), and a lack of instructional materials (Soriano & Vargas, 2021). Furthermore, large class sizes (Esguera, 2018) and insufficient training for teachers (David & Vizmanos, 2019) continue to be prevalent issues.

The COVID-19 pandemic has forced the education sector to rapidly transition to online learning, highlighting the importance of digital literacy and ongoing training for educators. It has demonstrated the need for creative teaching methods and the continuous evolution of technology in education. Hybrid learning, combining online and in-person instruction, will be essential in the future. Educators must adapt to become facilitators rather than traditional teachers. The pandemic experience is expected to positively influence educators' attitudes toward integrating technology in education. Ongoing digital skills training is necessary for educators to provide a quality education in the post-pandemic world (Nemalyne *et al.*, 2023).

This research is anchored on the following theories: Theory of Planned Behavior (Ajzen, 1991), Theory of Connectivism (Siemens & Downes, 2005), and Concerns Development Theory (Fuller, 1969). As teachers conduct online teaching, their behavior can be predicted by their intention to engage in online teaching. As online teaching heavily influenced by technology and on its initial implementation, teachers must know what levels of use they are and the concerns they have toward online teaching. This research is based on Ajzen's Theory of Planned Behavior, which he proposed in 1991. In 1980, this theory was developed from the Theory of

Reasoned Action. According to Teo (2012), a person's conduct is determined by his behavioral intents, which can be broken down into three categories: the individual's attitude toward behavior; subjective norms; and perceived behavioral control.

According to prior research conducted, the more positive one's attitude toward an action is, the more likely one is to engage in the behavior which gives an impact on the individual's decision to engage in that behavior. Subjective norm refers to an individual's belief that important individuals desire him to engage a particular conduct (Hagger & Chatzisarantis, 2005). The level of difficulty based on an individual's perception to accomplish behavior is defined as perceived behavioral control. One's confidence, or those who believe they can perform a certain activity, greatly influences his or her conduct, which tends to have a greater intention. As it helps to forecast future action, the Theory of Planned Behavior can establish the intention for non-visual circumstances that limit individual control.

This research is also based on George Siemens and Stephen Downes' Theory of Connectivism which was introduced in 2004. Siemens described it as a new learning theory heavily influenced by technology. Connectivism is a learning model that can guide teachers advising by integrating principles such as chaos, network, and complexity, as well as self-organization theories and an understanding that decisions are based on rapidly changing foundations (Siemens, 2004). Connectivism can be beneficial for academic advising as a theory that connects prior knowledge to current knowledge, incorporates technology into the realm of knowledge, and guides teachers to look beyond their own understanding to connect information.

Siemens proposed connectivism as a digital age learning theory. Connectivism views knowledge as distributed across networks, with connections and connectedness serving as a source of inspiration for learning. Connectivism is a learning theory that is heavily reliant on technology. It is based on the acquisition of knowledge with an eye toward the future, not the past (Siemens, 2005). George Siemens and Stephen Downes developed Connectivism as a response to the limitations of behaviorism, cognitivism, and constructivism in order to explain the effects of technology on how people live, interact, communicate, and learn.

The said theory describes the process of learning that occurs as a result of the creation of online communities' interpersonal connections. It recognizes that technology is an important element of the learning process and that constant connectivity allows people to make decisions about education. Connectivism encourages learning outside of the classroom, such as through social media, online networks, blogs, and information databases.

The connectivism theory evolved in the digital age, as technology enabled people to learn and share information via online networks. The theory emphasizes the ways in which internet technologies such as web

browsers, search engines, wikis, online discussion forums, and social networks contribute to the creation of new learning opportunities. Connectivism allows technology to become a part of the internal learning process. While older theories of learning have a place in the transmission of fundamental knowledge, instruction must embrace connectivism to ensure that knowledge in the twenty-first century is properly transmitted.

This research is also anchored on Concerns Development Theory (Fuller, 1969). Concern can be defined in the context of education and teachers as teachers' feelings, thoughts, and reactions to innovations (Hall & Hord, 2006). Teachers' concerns about innovation or change are generally evaluated in accordance with Fullers' Concerns Development Theory. According to Fuller's theory, teachers' concerns are divided into three categories: self (e.g., survival, self-adequacy, and acceptance); task (e.g., student performance and teacher responsibilities); and impact (e.g., social and educational impact on the system). According to Fuller (1979), a teacher could not progress to the next stage of concern without first resolving the previous stage's concern. The theory begins with a survival phase during which the teacher focuses on classroom management, instruction, content knowledge, and impressing supervisors. This stage is referred to as the neonate stage, in which the teacher is compared to a newborn thrust into an unfamiliar environment devoid of necessary comfort, safety, and familiarity. Once teachers realize that they can survive in the classroom, they begin to shift their focus away from self-preservation and toward their students. This stage is called consolidation because it entails the consolidation of disparate skills and knowledge into a coherent whole that can be used in the classroom. Teachers are more receptive to trying new methods and strategies during this stage because they are no longer concerned with survival. It is an incredible opportunity to offer a wealth of new professional development to help teachers broaden their horizons. The final stage is concerned with the impact. Teachers become more concerned with making a meaningful and significant difference in the lives of their students.

Hall, *et al.* (1979) developed an evidence-based conceptual framework, the Concerns-based Adoption Model (CBAM), based on Fuller's Concerns Development Theory. The CBAM applies to anyone experiencing change (George, *et al.*, 1977). According to the model, individuals contemplating and experiencing change evolve in terms of the types of questions they ask and the ways in which they use whatever the change is.

The Levels of Use tool is comprised of eight behavioral profiles that describe the actions educators take as they gain familiarity and skill with a practice or change: Level 0 (Non-use) indicates that no action has been taken in response to the innovation; Level 1 (Orientation) indicates that the user initiates the process of learning about the innovation; Level 2 (Preparation) indicates that the user has specific plans to implement the innovation; Level 3 (Mechanical) indicates that the user modifies the

innovation in order to better organize its use; Level 4A (Routine) indicates that the user makes few or no changes to his or her behavior and follows a well-defined pattern of use; Level 4B (Reinforcement) occurs when the user makes changes in order to improve the outcome; Level 5 (Integration) occurs when the user makes a conscious effort to coordinate (collaborate) with others when utilizing the innovation; and Level 6 (Renewal) indicates that the user looks for more effective alternatives to the innovation's established use.

The Concerns-based Adoption Model is a framework and a collection of tools for analyzing and managing human change. CBAM identifies Stages of Concerns (SoC) that individuals typically pass through as they adopt educational innovations (Hall & Hord, 2006). Concerns are defined in this framework as composite representations of the emotion, preoccupation, thought, and consideration directed toward a particular issue or task. There are seven stages of concern as follows: Stage 0 is Awareness; Stage 1 is Informational; Stage 2 is Personal; Stage 3 is Management; Stage 4 is Consequence; Stage 5 is Collaboration; and Stage 6 is Refocusing. These are the stages that individuals may go through when they adopt a new technology. Additionally, these seven stages fit comfortably within Fuller's three phases of self, task, and impact.

While research indicates that the concerns expressed by individuals as they progress through the change process follow a quasi-developmental path, the process is not necessarily sequential. This framework characterizes the process of change in general, which can provide useful information about teachers' overall attitudes toward educational innovation (George, *et al.*, 2006). Additionally, each educational innovation raises unique concerns for teachers as they implement new approaches, examine the general stages of concern, and the specific nature of those concerns can shed light on effective strategies for assisting teachers in continuing to implement new instructional practices.

In this study, the levels of use and the stages of concern frameworks characterize the Science teachers' concerns and the nature of change they experienced during the implementation of online teaching. Teachers play a critical role in implementing innovations in education such as online teaching. It is believed that to fully implement online teaching, it is necessary to determine the availability of technological learning application and tools, and teachers' levels of use of online teaching, and their stages of concerns in online teaching.

MATERIALS AND METHODS

This research made use of the descriptive – correlational research design since its aim was to determine the availability of technological learning applications and tools, science teachers' levels of use of online teaching, and their stages of concerns in online teaching.

This study was conducted in public elementary schools in the Schools Division of Laoag City. The schools in

this division are known to have established ICT tools and resources. These schools are located at the heart of the province. These schools are conducting online classes to their pupils aside from modular instruction. These schools are also furnished with ICT equipment through the DepEd Computerization Program and donations from stakeholders.

This study involved the teachers in the public elementary schools in the Schools Division of Laoag City who are teaching Science in online mode. These teachers teach Science subjects in Grades 3 to 6. These teachers were purposefully chosen in the study since teaching Science starts in Grade 3. Further, Science is being introduced in the third grade as per mandate in the K to 12 Curriculum. The teachers from the said division are implementing Online Distance Learning (ODL) as one of their delivery modalities as stipulated in the Regional Memorandum No. 384, s. 2020 aside from modular distance learning.

The main tool for gathering the data was a survey questionnaire. The survey questionnaire consists of four parts, namely: Part I – Socio-demographic Characteristics; Part II – Availability of Technological Learning Applications and Tools; Part III- Levels of Use of Online Teaching; and Part IV – Stages of Concerns in Online Teaching.

Questionnaires were distributed online via Google Form. An informal interview was further conducted to triangulate the results and of the data obtained from the survey questionnaire. Furthermore, it was ensured that time-on task and the policy on non-disruption of any school-related activity were observed in the conduct of this study.

Frequency, mean, percentage and standard deviation were used to analyze the data collected on the teachers' socio-demographic characteristics, availability of technological learning applications and tools, levels of use of online teaching, and stages of concern in online teaching. The Peak Stage Score Interpretation was used to determine each teacher's most intense stage of concern. The Pearson product-moment correlation (r) was used to ascertain the relationship between each of the socio-demographic profile variables and the availability of technological learning applications and tools, teachers' levels of use of online teaching, and their stages concerns in online teaching. The point-biserial correlation was used to determine the relationship between each of the socio-demographic characteristics of teachers (like sex and age) and the availability of technological learning applications and tools, teachers' levels of use of online teaching, and their stages concerns in online teaching.

RESULTS AND DISCUSSION

Socio-Demographic Characteristics of Science Teachers

Table 1 shows the socio-demographic characteristics of the science teachers. Findings show that most of the teachers are young adults with a mean age of 37.79 and are dominated by females (16 or 84.21%). Their mean years of

Table 1: Socio-Demographic Characteristics of Science Teachers

Socio-Demographic Characteristics	f	%
Age		
56-63	1	5.26
48-55	3	15.79
40-47	2	10.53
32-39	7	36.84
24-31	6	31.58
Total	19	100.00
Mean	37.79	
SD	9.83	
Sex		
Male	3	15.79
Female	16	84.21
Total	19	100.00
Mean	9.44	
SD	8.98	
Educational Attainment		
BS Graduate	1	5.26
MA Units	17	89.48
MA Graduate	1	5.26
Ed. D Units	0	0
Ed. D Graduate	0	0
Total	19	100.00
Number of Seminars and Trainings Attended Related to Online Teaching		
30-34	1	5.26
25-29	0	0
20-24	3	15.79
15-19	0	0
10-14	4	21.05
5-9	4	21.05
0-4	7	36.84
Total	19	100.00

teaching Science is 9.44. Majority (17 or 89.48%) of them have earned MA units. Only seven of them (36.84%) have attended seminars or training related to online teaching.

Availability of Technological Learning Application and Tools of Science Teachers

Availability refers to accessibility and affordability of technological learning applications and tools for teaching science. Table 2 reveals the distribution of teachers' accessibility of technological learning applications and tools in online teaching in terms of device/gadget ownership, internet connectivity, device/gadgets' features, and applications installed.

All the teachers (19 or 100%) own a smartphone, while 5 (26.32%) have a tablet, and 2 (10.53) have 2-in-1 laptop. Ownership of other mobile devices such as eBook reader, personal digital assistant, mp3 or mp4 player, conventional laptop, and a feature phone are also indicated. Eighteen (94.74%) of the teachers own a smartphone or device with internet connectivity. Ten (52.63%) of them own a portable wi-fi router. Of the features that may be used for online teaching, 18 (94.74%) of the teachers who are teaching online have SMS, Wi-fi, Bluetooth/Shareit, Memory Card/Google Drive, USB-on-the-go, photo/video-camera, audio/voice recording, web browser, calculator, calendar, dictionary, and video messaging application (Google Meet, Zoom). While 17 (89.74%) of them have media player and alarm clock/timer. Eighteen (94.74%) of the teachers can open, read, and edit the most used file types and documents in the conduct of online teaching including a pdf file, word document, word document, spreadsheet, PowerPoint, photo graphics, and audio/video files. When it comes to affordability of laptop or devices, applications, and related technologies, 12 (63.16%) of the teachers can afford to buy a laptop, while 12 (63.16%) of them can also afford to buy a smartphone or tablet. Sixteen (84.21%) of the teachers are willing to buy a laptop or tablet if they don't have one yet. Meanwhile, 12 (63.16%) of the teachers can afford to buy a laptop or a tablet with internet connectivity. Fifteen (78.94%) of the teachers are willing to buy laptop or tablet with internet connectivity or a portable Wi-Fi router to connect online, while 15 (78.94%) of them can afford and willing to buy applications for their device (if the application is not free).

Table 2: Teachers' accessibility of technological learning applications and tools in online teaching

Statements	f	%
Device/Gadget Ownership		
1. I own a smartphone.	19	100.00
2. I own a tablet.	5	26.32
3. I own a 2 in 1 laptop.	2	10.53
4. I own other devices like		
a. E-book reader	2	10.53
b. Personal digital assistant	4	21.05
c. Mp3 or Mp4 player	5	26.32
d. Conventional laptop	10	52.63

e. Feature phones	4	21.05
Internet connectivity		
5. I own a smartphone or tablet with internet connectivity	18	94.74
6. I own a portable Wi-fi router (e.g. Smartbro, PLDT)	10	52.63
Devices/Gadgets' Features		
7. My device/gadget has the following features		
a. Short message service (SMS)	18	94.74
b. WiFi	18	94.74
c. Bluetooth	18	94.74
d. Memory card/Google Drive	18	94.74
e. USB on-the-go	18	94.74
f. Photo/video camera	18	94.74
g. Audio/voice recording	18	94.74
8. The following applications are installed in my device/gadget		
a. Web browser	18	94.74
b. Media player	17	89.47
c. Calculator	18	94.74
d. Calendar	18	94.74
e. Alarm clock/countdown timer	17	89.47
f. Dictionary	18	94.74
g. Video platforms (e.g Google Meet, Zoom, Skype)	18	94.74
9. My device/gadget can open/read and/or edit a		
a. PDF document	18	94.74
b. Word document	18	94.74
c. Spreadsheet	18	94.74
d. PowerPoint	18	94.74
e. Photo/graphics	18	94.74
f. Audio/video files	18	94.74

Table 3: Teachers' affordability of technological learning applications and tools. (n=19)

Statements	f	%
1. I can afford to buy a laptop.	12	63.16
2. I can afford to buy a tablet.	12	63.16
3. I am willing to buy a laptop or tablet if I don't have one yet.	16	84.21
4. I can afford to buy a laptop or tablet with internet connectivity	12	63.16
5. I am willing to buy a laptop or tablet with internet connectivity or a portable Wi-Fi router to connect online.	15	78.94
6. I can afford and am willing to buy apps for my device (if app is not free).	15	78.94

The results imply that the affordability of technological learning applications and tools among the teachers, is a factor in the implementation of online teaching which is required of them to function effectively in a variety of learning environments, particularly online teaching. Affordability contributes to the accessibility of the teachers as regards the technological learning applications and tools.

The high percentage of accessibility and affordability as regards device/gadget ownership, internet connectivity, device/gadgets' features, and applications installed, and the willingness of teachers to buy devices/

laptops, subscribe to internet plans, buy and download applications, and other related technologies, indicate that the teachers have the availability of technological learning applications and tools used in online teaching.

Teachers' Levels of Use of Online Teaching

Table 4 shows the distribution of the teachers according to their levels of use of online teaching. None of the teachers are classified under Level 1 – Orientation, Level 2 – Preparation, Level 3 – Mechanical Use, or Level 4A – Routine, while the heaviest grouping of teachers is found at Level 5 - Integration with 8 (42.10%) teachers. Teachers

Table 4: Teachers' levels of use of online teaching

Level of Use	f	%
Level 6 – Renewal	6	31.58
Level 5 – Integration	8	42.10
Level 4B – Refinement	5	26.32
Level 4A – Routine	0	0
Level 3 – Mechanical Use	0	0
Level 2 – Preparation	0	0
Level 1 – Orientation	0	0
Total	19	100.00

at this level are consciously coordinating their use of the innovation with others. In the implementation of online teaching, they make little alterations and adaptations. They collaborate with others in order to make a larger impact on students.

Moreover, 6 (31.58%) teachers are within Level VI -Renewal. These teachers are investigating, assessing, and developing specific plans for change. They analyze online teaching in usage and look for significant modifications or alternatives that have a greater influence on learners.

Furthermore, Table 4 reveals that 5 teachers (26.32 %) are within Level 4B - Refinement. This means that their reactions to changes in online teaching are mostly focused on the pupils. In order to help their pupils learn more efficiently, the teachers try out different abilities and techniques. In the course of online teaching, the teachers' major is to improve their students' learning.

Changes are made to increase the efficacy and good outcomes associated with online teaching as teachers progress to a higher level of utilization. The basic goal of teachers is to increase their pupils' effects.

The lower levels of Mechanical and Routine represent an initiative's day-to-day adaptability at the surface level of change. Mechanical and routine-level teachers incur the risk of inadequate implementation in which the program is applied directly to practice with little or no absorption of underlying concepts or integration (Hall & Hord, 1987). As teachers progress to higher levels of use of teaching, adaptations are meant to improve the effectiveness and good effects of online teaching. To have a collective influence, teachers are making conscious attempts to coordinate and combine activities and starts looking into alternatives or big changes to online teaching.

Teachers' levels of use of online teaching highlight the importance of collaboration, continuous improvement, and student-centeredness in the implementation of online instruction. As teachers progress to higher levels of utilization, they are consciously making adaptations and seeking alternatives to enhance the effectiveness and positive outcomes associated with online teaching. This signifies a positive shift towards a more integrated and impactful online learning environment for students.

Teachers' Stages of Concern in Online Teaching

In terms of the peak concern of respondents' stages

of concern, Table 5 shows the frequency counts and percentages of the teachers' stages of concern illustrating their peak concern in relation to the Theory of Concern Development and the Concerns-Based Adoption Model (CBAM) in the implementation of online teaching.

Table 5: Teachers' stages of concern in online teaching

Stages of Concern	f	%
Impact Concerns		
Stage 6- Refocusing	1	5.26
Stage 5- Collaboration	0	0.00
Stage 4- Consequence	0	0.00
Task Concerns		
Stage 3- Management	0	0.00
Self-Concerns		
Stage 2- Personal	0	0.00
Stage 1- Informational	1	5.26
Stage 0- Awareness	17	89.47
Total	19	100

As shown in the table, 18 (94.74%) of the teachers are still in the self-concern stage, no one is under the task concern, and only one (5.26%) under the impact concern stage. Of the 19 respondents, the table reveals that 17 (89.47%) teachers are under Stage 0, the Awareness Stage. According to Hall *et al.* (1997), users of an innovation that score high at Stage 0 indicate lack of concern about the innovation. This means that most of the teachers hold little concern about or involvement in the conduct of online teaching. Further, the teachers' attention is focused more on other tasks and activities which are expected of them to accomplish.

It can be noted that the teachers are more focused in coping and surviving in a new environment and innovation since online teaching is on its initial implementation. The results show similarity on the study of Ruiz (2020) on the implementation of game-based learning platforms in teaching and learning Physics where most of her respondents fall under Stage 0. In another study, Cabello (2020) found out in her study that too much paper works, workloads, and non-academic intervening activities are some of the barriers that affect the implementation of the Philippine Informal Reading Inventory (Phil-IRI) program. Teachers' other tasks and workload must be reduced so that they are willing to participate in the program's implementation. For these teachers in this study, most of their concerns are particularly on other tasks such as printing modules, paper works, and internet connection in the conduct of online teaching. This study corroborates with the findings of Ancheta (2015) that teachers at this level are unconcerned with innovation since they are focused with the duties allocated to them by their respective schools.

Meanwhile, only one (5.26%) of the teachers fall under Stage 1- Informational, which means that the teacher has very limited knowledge about online teaching. However,

the result implies that the teacher is interested in having more information about the innovation. He or she is not concerned about the most important aspects of online teaching or its practical details, but the general information about what the innovation and what it will do to him or her. Natividad (2014) believes that most teachers at this stage are intensely concerned about what the innovation is and what are involved in its use.

None of the teachers are classified under Stages 2, 3, 4, or 5. The absence of Stage 2 concerns shows that the teachers are unconcerned with their status, reward, and the effect of the innovation on themselves. The findings are consistent with those of Reyes (2014) that teachers at this stage may have lacked confidence in themselves or in the assistance of others. In the case of this study, this means that online teaching has no personal impact on the teachers.

The absence of teachers expressing Stage 3 concerns suggests that they are not concerned with the organization, management, timing, and logistical implications of the innovation (Ruiz, 2020). This indicates that the teachers have not yet begun experimenting with online teaching.

The absence of Stage 4 concerns implies that teachers are not concerned about improving their capacity and style for enabling change (Reyes, 2014). Abara (2016) stated that teachers should be given opportunities to observe how innovations are implemented in various settings.

The absence of teachers expressing Stage 5 concerns shows that there is no concern about coordinating the innovation's facilitation (Hall *et al.*, 1979). The teachers are extremely concerned about collaborating and cooperating with colleagues or others with the use of innovation.

Only one (5.26 %) of the teachers falls under Stage 6 - Refocusing Stage. The teacher's actions do not merely reflect a desire to acquire additional knowledge. The teachers have varying viewpoints on the innovation and are keen in seeing the concepts adopted, if not tested.

Reyes (2014) discovered that in many instances, individuals with high Stage 6 concerns offered proposals for replacing or considerably altering the innovation in its existing form. The results are also similar with the findings of Cabello (2020) that the majority of the English teachers are not concerned about or involved in the behavior of Philippine Informal Reading Inventory (Phil-IRI). Additionally, the teachers' attention is diverted

from other responsibilities and activities that are expected of them that the program is not always their priority.

For all the three stages combined (Stages 0 through 2) or the self-oriented concerns based on Fuller's Concerns Development Theory, or 18 (94.7%) out of 19 the teachers scored high in one of these three stages. The result shows that for the teachers adopting the innovation that their self-concerns are high and impact concerns with approximately 5% were less evident.

The result corroborates the study of Fuller (1969) and Ancheta (2015) that teachers have self-oriented concerns at the start of a newly adopted program. Notably, online teaching was first implemented in 2020 as learning modality in the height of pandemic. Thus, such result is expected.

Teachers' Socio-demographic Characteristics and Availability of Technological Learning Applications and Tools

Table 6 shows that there is no significant relationship between teachers' age, sex, number of years teaching in Science, educational attainment, and the number of trainings attended in online teaching, and the availability of technological learning applications and tools. This implies that regardless of their socio-demographic characteristics, teachers have equal access to and affordability of technological learning applications and tools in online teaching during the pandemic. These findings are consistent with previous studies that found no differences in the implementation of technology based on factors such as age, gender, educational attainment, and training attendance. This suggests that both younger and older teachers are eager to embrace new innovations, and socio-demographic characteristics do not hinder the availability and utilization of technological tools in education. The results also align with research on the technological preparedness of teachers, indicating that age, educational attainment, and training attendance are not significantly related to teachers' readiness to adopt technology for teaching purposes. Teachers, regardless of their socio-demographic characteristics, can adapt to the changes in the educational landscape brought about by the pandemic and strive to meet the expectations set by the Department of Education. The findings suggest that teachers, irrespective of their age, sex, teaching experience,

Table 6: Coefficient of correlation between the teachers' socio-demographic characteristics and the availability of technological learning applications and tools, levels of use of online teaching, and stages of concern in online teaching

Variables	Availability of Technological Learning Applications and Tools		Levels of Use		Stages of Concern	
	r	p-value	r	p-value	r	p-value
Age	.179	.463	.301	.210	.078	.752
Sex	.139	.571	.037	.882	.078	.752
Numbers of Years teaching in Science	-.150	.540	.789**	.000	.240	.323
Educational Attainment	.023	.926	.401	.089	-.009	.970
Number of Trainings Attended	-.414	.078	-.049	.842	.195	.423

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

educational background, or training attendance, can adapt to online teaching and have equal opportunities to access and utilize technological learning applications and tools. The study emphasizes the resilience and commitment of teachers in fulfilling their roles in the alternative learning modality during these challenging times.

Teachers' Socio-demographic Characteristics and their Levels of Use of Online Teaching

Table 6 clearly presents that there is a significant relationship between the teachers' number of years in teaching in Science and their levels of use of online teaching with a correlation coefficient of 0.789 at the 0.01 level of significance. This suggests that teachers with a greater number of years teaching in Science has higher levels of use of online teaching. It is expected that the more years the teacher renders in teaching, the wider knowledge he or she has in the context of online teaching. They try to adjust their levels of use in online teaching. The teachers with more number of years teaching in Science have higher levels of use of online teaching since they have a wider perspective because they have been presented with experiences and in so doing, they are trying to adjust their levels of use of online teaching to fit in the context.

Further, it can also be noted that most of the teachers are young adults. They are generally young in the teaching profession. These teachers have high levels of use of online teaching since they are part of the Information Age (Atkins & Vasu, 2000). They have been exposed to networks such as internet, mobility such as work or social interaction from any location, digitization, and immersive experience, which allow them to coordinate their use of online teaching to others. It can be gleaned from the table that there is no significant relationship between the teachers' age, sex, educational attainment, number of trainings attended in online teaching and their levels of use of online teaching. This implies that whether the teacher is young or old, male or female, it does not affect his/her performance or use of online teaching. Thus, teachers' socio-demographic characteristics on age, sex, educational attainment, number of trainings attended related to online teaching and their levels of use of online teaching are two independent variables.

The findings of Cabello (2020) are quite similar to the aforementioned results wherein she found out that the English teachers' age and number of trainings attended related to reading are not significantly related to their levels of use of the Philippine Informal Reading Inventory (Phil-IRI). Likewise, that of Ruiz (2020) that there is no significant relationship between the Physics teachers' age and their levels of use in using Game-based Learning Platform (GBLP) in teaching and learning Physics.

Teachers' Socio - demographic Characteristics and their Stages of Concern in Online Teaching

As shown in Table 6, there exists no significant relationship between the teachers' socio-demographic characteristics

and their stages of concern in online teaching. This implies that their socio-demographic characteristics do not influence their stages of concern in online teaching. This finding is similar to those of Wang and Chou (2016) that age is not significantly related to the stages of concerns of elementary teachers in integrating character education in instruction. In addition, Ruiz (2020) found that the Physics teachers' sex is not significantly related to their stages of concerns in using Game-based Learning Platform (GBLP) in teaching and learning Physics. Furthermore, Cabello (2020) found out that the number of trainings attended by the English teachers in elementary, does not affect their stages of concern in the implementation of the Philippine Informal Reading Inventory (Phil-IRI). The result obtained implies that the teachers are already equipped with the knowledge and skills in connection to the nature of online teaching since they have been conducting ICT-related seminars even before the pandemic.

It can be inferred that only the teachers' number of years in teaching Science is significantly related to their levels of use of online teaching. The teachers' age, sex, educational attainment and number of trainings or seminars attended are not significantly related to their levels of use of online teaching.

Availability of Technological Learning Applications and Tools and Teachers' Levels of Use of Online Teaching

Table 7 shows the relationship between the availability of technological learning applications and tools and teachers' levels of use of online teaching. It can be observed from the table that the availability of technological learning applications and tools and the teachers' levels of use of online teaching are not significantly related. This implies that the availability of technological learning applications and tools used by the teachers does not affect their levels of use of online teaching.

Table 7: Coefficient of correlation between the availability of technological learning applications and tools and the teachers' levels of use of online teaching and their stages of concerns in online teaching

Variables	Level of Use		Stages of Concern	
	r	p-value	r	p-value
Accessibility	-.126	.607	.084	.733
Affordability	-.154	.528	-.509	.026
Overall	-.180	.461	-.449	.054

The result implies that since all of the teachers have the availability of technological learning applications and tools, this does not affect their levels of use of online teaching because the teachers depend on the context of online teaching, particularly on their pupils. Regardless of the availability of technological learning applications and tools, the decision as to the levels of use is on the context of online teaching. If the context of the pupils has not

enough technological devices/gadget or poor internet connection, they could not attend the online class even if the teacher has the availability of technological learning applications and tools. Hence, teachers cannot modify. According to a survey conducted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2020, about 826 million pupils who are held out of classrooms lack access to a household computer, while 706 million lack access the internet at home. This alienates economically disadvantaged children, particularly those living in rural in the country, where access to technology is limited. Moreover, hundreds of students cannot still access online learning due to lack of equipment (The Hechinger Report, 2020).

Availability of Technological Learning Applications and Tools and Teachers' Stages of Concerns in Online Teaching

Table 7 also reveals the relationship between the availability of technological learning applications and tools and teachers' stages of concerns in online teaching. The table reveals no significant relationship between the availability of technological learning applications and tools and teachers' stages of concern in online teaching. This implies that the availability of technological learning applications and tools does not affect the teachers' stages of concerns in online teaching. Regardless of the availability of technological learning applications and tools, the context of online teaching on the part of their pupils dictates the teachers' stages of concern. If the pupils' environment lacks sufficient technical devices/gadgets or has poor signal internet connection, they will not be able to participate in the online class, even if the teacher can access and afford the technological learning applications and tools. Results show that the teachers fall under Stage 0 (Awareness) in online teaching.

Relationship between Teachers' Levels of Use of Online Teaching and their Stages of Concerns in Online Teaching

Table 8 reveals the relationship between the teachers' levels of use of online teaching and their stages of concern in online teaching. It can be observed from the table that the teachers' levels of use of online teaching and their stages of concerns in online teaching are not significantly related. The result indicates that teachers' levels of use of online teaching is not a significant factor that affects or influences their stages of concern in online teaching. Thus, both

variables are independent to each other.

The result further implies that the teachers conducting online teaching simply depends their modification based on their pupils' situation on the context of online teaching. Though they want to modify sometimes, they could not since not all the time that pupils have stable internet connection. The teachers often worry about their pupils' connection in the conduct of online teaching. To deal with this situation, the teachers sometimes even raise fund to purchase the needs of their pupils.

Several studies also conform with the obtained results that the levels of use and the stages of concern are not significantly related. In the study of Cabello (2020) on the relationship of teachers' concerns to the degree of implementation of Philippine Informal Reading Inventory (Phil-IRI), she found that the teachers' stages of concern and their levels of use of Philippine Informal Reading Inventory (Phil-IRI) are two independent variables. They do not significantly affect each other. Although concerns or attitudes are considered as one of the factors that would influence the actual behavior of an innovation, Cheng Ling, *et al.* (2011) also found the stages of concern do not have any significant effect on the levels of use of the Quality Management System in Malaysia.

CONCLUSION

Based on the findings of the study, the following conclusions were drawn. Majority of the teachers have the availability of technological learning applications and tools in online teaching in Science. There is a high percentage of accessibility and affordability of technological learning applications and tools used in teaching Science online. Majority of the teachers are coordinating their use of online teaching with others. However, the teachers lack awareness and concern about online teaching. Only the teachers' number of years in teaching Science greatly influence the teachers' level of use of online teaching. Moreover, the availability of technological learning applications and tools do not affect the teachers' levels of use of online teaching and their stages of concern in online teaching. Also, the teachers' levels of use of online teaching and their stages of concern do not influence each other. The availability of technological learning applications and tools allows the teachers to conduct online teaching and it greatly influences their capacity to teach online, which tends to have a greater intention toward online teaching as perceived by the Theory of Planned Behavior. The Theory of Connectivism is beneficial for the teachers as they connect their prior knowledge about teaching Science to current knowledge. They incorporate technology into teaching Science and guides teachers to look beyond their own understanding to connect information. The principles of CBAM is an effective tool in identifying the teachers' levels of use of online teaching and their stages of concern in online teaching that could lead to the better implementation of online teaching.

In the light of the findings and conclusions, the following

Table 8: Coefficient of correlation between the teachers' levels of use of online teaching and their stages of concern in online teaching

Variables	Level of Use		Stages of Concern	
	r	p-value	r	p-value
Level of Use	1		.071	.772
Stages of Concern	.071	.772	1	

recommendations are offered. Based on the findings and conclusions of the study, several recommendations are offered. The teachers should be aware and be involved in the implementation of online teaching so that they would be able to give their best in dealing with the needs of their learners as regards to their use of online teaching. They should attend trainings and seminars in online teaching. Furthermore, creating a good working relationship with the colleagues is proposed to help one another in the implementation of online teaching. The administrators are encouraged to get involved in the identification of the teachers' levels of use of online teaching and their stages of concern in online teaching and recommend necessary supervisory actions that could help improve the status of the teachers. Moreover, providing professional development activities for their teachers is highly recommended for them to acquire needed competencies required of them for the implementation of online teaching. The policy makers are encouraged to provide teachers seminars and training for online teaching to help teachers understand its content and avoid confusions. The Department of Education and the LGUs should also work together in providing stable internet connection to students in the conduct of online teaching. They should partner with the different telecommunication agency to concretize a plan on how students could attend to their online class. They should also consider the situation of the students in the conduct of online teaching. Further, future researchers are encouraged to conduct similar study on a wider scope and greater number of respondents to validate the findings of the study. Since online teaching is on its initial implementation, it is also suggested that more studies be conducted not only on the teachers' stages of concern and levels of use of online teaching but also other factors affecting the implementation of online teaching in Science.

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