THE MODERATING EFFECT OF PROFESSIONAL DEVELOPMENT TO TECHNOLOGY LEADERSHIP OF SCHOOL ADMINISTRATORS AND TECHNOLOGY INTEGRATION

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Abstract: The purpose of study the moderating effect of professional development to technology leadership of school administrators and technology integration is to determine the level of technology leadership of the school administrators and the level of technology integration of teachers; to investigate if there is a significant relationship between technology leadership and technology integration; and to find out if professional development, in terms of, educational attainment, and number of ICT-related training and seminars attended, moderates the relationship between technology leadership and technology integration. The study used a descriptive and correlational method of research and a moderation analysis. The researcher administered the questionnaires to 180 secondary school teachers in Candelaria East District. Based on the results of the study, there is a high level of technology leadership of school administrators, and a high level of technology integration of teachers. It was concluded that there is a positive strong relationship between technology leadership and technology integration. Furthermore, professional development in terms of highest educational attainment does not moderate the relationship between technology leadership and technology education. Contrary to numbers of trainings and seminars which significantly moderates the effect between technology leadership and technology integration.

Keywords: technology leadership, technology integration, professional development

INTRODUCTION

Currently, the education system all over the world is embracing the vision and aims of the Fourth Industrial Revolution which calls for the advancement of technology (Hero, 2020). This constant evolution of technology is something we can no longer ignore because it has left no area of our lives untouched, and it became recurring and inevitable. It has also triggered the demand for changes in our educational system. In 2013, K-12 curriculum was implemented in the Philippines that necessitates the use of modern technology in the 21st century classroom. In 2020, the Covid 19 pandemic reminded us once again the importance of technology which has resulted to an increase usage of digital technologies due to nationwide lockdowns and social distancing (Pandey and Pal, 2020)

This phenomenon has given birth to new leadership style which is technology leadership. Many researchers have identified technology leadership as a new kind of leadership in some countries such as United States, Taiwan, Canada, and Malaysia. Technology leadership is defined as a process of providing support for teachers in using computers to make more meaningful and productive teaching and learning in the 21st century (Okeke, 2019).

The technology leadership phenomenon started to appear in the United States in the early 1990s. ISTE (International Society for Technology and Education) conducted this phenomenon most extensively. ISTE developed technology standards where leaders need to be acquainted with. ISTE proposed that the qualities of a technology leader be based on aspects, which include a focus on equity, digital citizenship, and visionary planning. The desired outcomes aim to empower leaders to recognize teachers' innovative use of technology to enhance teaching and learning. Furthermore, strong technology leaders are connected learners who model and promote continuous professional learning for themselves and others. It also focuses on the knowledge and behaviors that our educational leaders ought to have to empower teachers and make student learning possible. Equity and Citizenship Advocate, Visionary Planner, Empowering Leader, Systems Designer, and Connected Learner are

among the five constructs of Technology Leadership in ISTE standards. These will provide a comprehensive roadmap to effectively use technology in education. Consequently, principals must know how they will guide and motivate teachers to integrate it into their work (ISTE, 2018).

As 21st century leaders, principals are expected to play an integral role in technology integration (Kozloski, 2006). They were expected to clearly communicate the importance of the effective use and integration of technology in schools (Gencer and Samur, 2016). Their goal is to inspire teachers to integrate technology into the curriculum and to become competent with technology. Through technology leadership, teachers may demonstrate more teaching innovation (Hsie, et. al, 2014). It is acknowledged that teachers who are led by technology leadership will feel more comfortable when utilizing technology in the classroom (Dexter and Richardson, 2020). Likewise, school principals' technological leadership has a positive effect on teachers' technology integration (AlAjmi, 2022) (Thannimalai and Raman, 2018). The support of a principal helps teachers to enhance the use of technology in the classroom. Thus, school principals should help the process of learning with these technologies by defining a compelling vision of ICT use, preparing for staff development, and providing support for ICT users in their schools.

Accordingly, this study sought to evaluate the level of technology leadership and technology integration of teachers, and how it is moderated by the professional development. Given the importance of technology in our education, the study aimed to know to what extent of technology leadership is practiced by the principals based on the perceptions of the teachers. It also identifies the attitudes of teachers towards technology and determines their level of technology integration into teaching and learning.

OBJECTIVES OF THE STUDY

The purpose of this study is to evaluate the level of technology leadership of school administrators and to determine the level of technology integration of teachers. Given the importance of technology in our education, the study aimed to know to what extent of technology leadership is practiced by the principals based on the perceptions of the teachers. The researchers would also like to find out the significant relationship between technology leadership and technology integration. The moderation effect of professional development with regards to educational attainment and ICT-related training and seminars, is also determined in the study.

METHODOLOGY

Research Design

This study is a quantitative descriptive correlation research design and a moderation analysis. Quantitative descriptive correlational research is used to know the level of technology leadership of school administrators, the level of technology integration. It is also designed to establish the relationship between the two variables: the technology leadership and technology integration. The moderation analysis is used to know how the relationship of technology leadership and technology integration is moderated by the professional development such as highest educational attainment, and numbers of ICT-related trainings and seminar attended.

Respondents of the Study

The respondents of the study are secondary public-school teachers in Candelaria East District situated in the municipality of Candelaria, province of Quezon. The respondents are the secondary school teachers who are currently associated with the three (3) public secondary schools in Candelaria East District. There are total of 180 respondents; 64 from Dr. Panfilo Castro National High School; 32 from Dolores Macasaet National High School; and 84 from Sta. Catalina National High School.

Research Instrument

The instrument used by the researcher was an adapted survey questionnaire to gather the data needed from the respondents. The questionnaire has three parts; first part is the demographic profile of the respondents including the highest educational attainment, and numbers of ICT-related training and seminars of the respondents; second part is the adapted survey questionnaire for technology leadership taken from ISTE (International Society for

Technology in Education) Standards for Educational Leaders in 2018; the third part is an adapted survey questionnaire for Technology Integration from the Teacher's Technology Integration Survey (TTIS).

Research Procedure

This study was done through the following research procedures:

Conceptualization. In exploring topics on technology leadership and technology integration, several consultations were made between the researcher and the adviser. The researcher presented the concept formulated and prepared to the panel members and solicited suggestions to further improve the content of the paper.

Implementation. The researcher made a letter of request to conduct the study. The researcher also prepared the needed data sharing form. The study was conducted after the approval of the District Supervisor, and Principals of the involved school. An online adapted survey questionnaire through google form was used, and the link was sent to the respondents.

Validation. To ensure the consistency and accuracy of the survey questionnaire, the researcher presented it to the thesis adviser and other panel members for correction and suggestions on its enhancement. It is also validated by four Master Teachers and one Head Teacher.

Data Analysis. After the respondents completed the online survey questionnaire, the researcher gathered the data. The data gathered was recorded, and data matrix was prepared. The researcher presented the data matrix to the statistician and adviser. Then, it was submitted to the statistics center to be subjected to statistical treatment.

Ethical Consideration. The researcher ensured the privacy of the research respondents. An adequate level of confidentiality of the research data from the online survey questionnaire was guaranteed. The researcher honestly presented the data collected from the respondents.

Statistical Treatment of Data

The data and information that was obtained from the responses were tallied, organized, analyzed and interpreted using statistical tests. descriptive statistics such as mean and standard deviation were used to describe the level of principals' technology leadership and teachers' technology integration. The spearman correlation coefficient was used to determine the relationship of technology leadership and technology integration since the data are not normally distributed. To determine whether the relationship between technology leadership and technology is moderated by highest educational attainment and numbers of ICT-related training, moderation analysis was performed.

RESULTS AND DISCUSSION

The data collected were analyzed and interpreted where the basis of conclusions and recommendations of the study are drawn.

Table 1. Professional Development Profile of the Respondents

	Demographics	Frequency	Percentage
Highest Educational Attainment	Bachelor's Degree	41	22.8
	With MA units	62	34.4
	Masters' Degree	63	35.0
	With Doctoral Units	12	6.7
	Doctorate Degree	2	1.1
Number of ICT-related	0-1	71	39.4
	2-3	70	38.9

training and seminars	4-5	24	13.3
	6-7	2	1.1
	8 and above	13	7.2

The respondents of the study were 180 secondary school teachers. Among these, 35% or 63 have Masters' Degree. It is followed by respondents with MA units which is 34.4% or 62. Respondents with bachelor's degree are only 22.8% or 41, and 12 or 6.7% have doctoral units. The lowest number have a doctorate degree which is only 2 or 1.1%.

In number of ICT-related training and seminars, 39.5% or 71 have not attended or have only one ICT-related training and seminars. 38.9% or 70 have attended 2-3 ICT-related training and seminars. Moreover, only 15 respondents attended a significant number of ICT-related training and seminars, in which 2 respondents have 6-7 training and seminars, and 13 have participated in more than 8 training and seminars.

Table 2. Level of Technology Leadership of School Administrators as Perceived by the Teachers

Dimensions	Mean	SD	Level
Equity and Citizenship Advocate	3.21	0.62	High
Visionary Planner	3.36	0.62	High
Empowering Leader	3.44	0.61	High
Connected Learner	3.35	0.63	High

Legend: 3.50-4.00 (Very High); 2.50-3.49 (High); 1.50-2.49 (Low); 1.00-1.49 (Very Low)

Table 2 shows the level of technology leadership of school administrators as perceived by the teachers. The result reveals the mean of Equity and Citizenship Advocate is 3.21. This suggests that respondents perceived that their school administrators display a high level of technology leadership as an equity and citizenship advocate. The finding is consistent with the result of the study of Paloma (2023) who found out that the degree of technology leadership with regards to equity and citizenship advocate obtained a "high level". This indicate that technology leadership of principals in targeted public secondary schools ensures that all students have skilled teachers who actively use technology to meet their learning needs and cultivates responsible online behavior, including the safe and ethical use of technology.

Furthermore, the overall weighted mean of Visionary Planner is 3.36, indicating a high level of technology leadership in terms of visionary planning. Technology leaders as visionary planners are communicating effectively with stakeholders to gather input on the plan, and they celebrate successes and engage in a continuous improvement cycle. These findings support the study of Beytekin (2014) which indicates that school administrators were believed to be most efficient in visionary leadership. The result is also in line with the study of Paloma (2023) in which visionary planner attained a very high weighted mean which implies that respondents strongly agree that their school principals/school heads are sharing lesson learned and best practices, engaging in developing shared vision in using technology, and communicating effectively with the stakeholders.

The table also shows the mean of technology leadership as to empowering leader. It reveals a mean of 3.44 which implies a high level of technology leadership as an empowering leader. These outcomes are evident that they build a culture in which teachers and students are encouraged innovatively and creatively to improve teaching and learning. They also motivate teachers to strengthen their digital citizenship skills by encouraging them to participate in technology-related-in-service training. This is affirmed in the study of Beytekin (2014), highlighting that empowering leader is at high level which suggests that it stand out as a key focus of the duty and responsibilities of a school principal. This is also in the agreement of Paloma (2023), that the level of technology leadership as to empowering leader is very high, highlighting that leaders have truly understand their role as an empowering leader. However, according to, Karakose, Polat, and Papadakis (2021) their respondents claimed that their school principals did not encourage the technology integration in their schools.

Also illustrated in the table, the mean of 3.35 for connected learner. It indicates that respondents perceived that their school principals/school heads display a high level of technology leadership as a connected learner. They develop the skills needed to lead and navigate change. They also often promote a mindset of continuous improvement for how technology can improve learning. Moreover, principals/heads as connected learners model and promote continuous professional learning for themselves and others. According to Omar, Noor, and Ismail (2020), principals are responsible to promote training opportunities and professional development to improve the teachers ICT skills.

Based on these findings, school administrators display a high level of technology leadership as an equity and citizenship advocates, visionary planners, empowering leaders, and connected learners. Similar findings were found in the study of Omar, Noor and Ismail (2021) and Paloma (2023) who argue that principals practice high level of technology leadership. It confirms that respondents perceived their school principals/school heads exhibiting a high level of technology leadership. As such, school principals/heads are considered to have the abilities and skills required to thrive in their roles as technology leaders.

Table 3. Level of Technology Integration of Teachers

Dimensions	Mean	SD	Level
Comfort with Technology	3.45	0.56	High
Beliefs and Behaviors about Technology Use	3.39	0.57	High
Benefits of Technology Use	3.61	0.52	Very High
Technology Support and Access	3.25	0.54	High
Administrative and Instructional Use	3.59	0.51	Very High
Communication Use	3.44	0.61	High
General Student Use	3.35	0.57	High

Legend: 3.50-4.00 (Very High); 2.50-3.49 (High); 1.50-2.49 (Low); 1.00-1.49 (Very Low)

Table 3 shows the level of technology integration practiced by the teachers. Based on the findings, with a mean of 3.45, the respondents demonstrate a high level of technology integration in terms of comfort with technology. It confirms that respondents are comfortable in using technology. It also suggests that they are confident in trying to learn new technologies on their own, comfortable with their ability to work with technology, and get excited when new technology application and tool are introduced to students. This finding resembles the result of the study of Jacinto and Samonte (2021), which concluded that teachers were comfortable and experienced no anxiety in using technology.

The table also shows the mean of beliefs and behaviors about technology use which is 3.39. It shows that respondents agree about the beliefs and behaviors on how technology could be used to enhance student learning. They are regularly planning the learning activities in which students use technology. They also model effective technology use for the students, and they believe that teaching students to use technology is part of their job. As mentioned by Kumar and Daniel (2016), many of their respondents believe that integrating technology will contribute to the effectiveness of their teaching, therefore, it will provide a greater opportunity for student engagement. Additionally, the mean of 3.25 display a high level of technology integration as to technology support and access. It signifies that respondents are receiving a high level of technology support from their school principals/school heads.

The table also display a high level of technology integration in terms of communication use. It is supported by the mean score of 3.44. Respondents agree that they utilize technology such as email for official transactions, communicate with stakeholders, and submit school reports, and use applications or social media platforms to submit reports and post class information. Moreover, the general student use resulted to a mean of 3.35 which indicates a high degree of technology integration as regards to general student use. It indicates that they encourage their students to use computer application such as internet, power point, word processors, spreadsheets and the like.

Among the indicator, benefits of technology use obtained the highest mean of 3.61 which indicates a very high level of technology integration in terms of benefits of technology. This connotes that the use of technology is believed by the respondents to be highly beneficial. Among the perceived benefits of using technology is that it allows them to be more effective in their job and creating materials using technology to enhance their teaching. It was followed by administrative and instructional use with a mean of 3.59 with a very high level. This means that the level of utilization of technology in administrative and instructional use is very high. Respondents strongly agree that they use technology such as MS Words, MS Excel, MS Power Point, and other computer applications. This finding is opposing the study of Jacinto and Samonte (2021) which identified that the respondents' usage of computer applications for instructions is below average. Also, many of them do not use applications such as word processing, spreadsheet, power point, and internet. Overall, it was concluded that teachers' technology integration is at "high level". A'mar and Eleyan (2022) who argue that teachers practice a high level of technology integration supports these findings.

Table 4. Significant Relationship between Technology Leadership and Technology Integration

Technology Integration	Technology Leadership				
	ECA	VP	EL	CL	Over-all TL
Comfort with Technology	.585**	.455**	.495**	.503**	.556**
Beliefs and Behaviors about Technology Use	.546**	.468**	.422**	.493**	.536**
Benefits of Technology Use	.488**	.452**	.450**	.476**	.505**
Technology Support and Access	.636**	.630**	.582**	.676**	.688**
Administrative and Instructional Uses	.567**	.455**	.528**	.470**	.554**
Communication Use	.523**	.452**	.449**	.483**	.528**
General Student Use	.596**	.462**	.474**	.476**	.548**
Over-all Technology Integration	.850**	.779**	.760**	.757**	.868**

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

Table 4 shows the computed spearman's correlation coefficient at 0.01 level (2-tailed) of the technology leadership and technology integration. The overall correlation value of technology leadership and technology integration is .868. The result reveals a strong significant correlation between the variables which connotes that technology leadership is a highly significant factor to increase the level of technology. This means that the level of technology integration increases if school principals practice a higher level of technology leadership. As stated by Ghavifekr (2015), for technology-based teaching and learning start by receiving sufficient implementation and support from school administration.

These findings can be affirmed in the study of Thanimalai and Raman (2018), Fisher and Waller (2013), AlAjmi (2022), Hsie, et. Al. (2014), and Wei, et. al (2016), Nawawi (2022) which concluded that technology leadership has a positive effect on technology integration. Therefore, it was determined that the support of a principal helps teachers to enhance the use of technology in the classroom. However, it is contrary to Hero (2020) who found that technology leadership has little effect on teachers' technology integration. Furthermore, it also contradicts Paloma's (2023) study, which concluded that there is no significant relationship between technology leadership and technology integration. This implies that technology leaders may not be able to make changes on how technology is used in the classroom. Alayan (2022) also found a weak correlation between technology leadership and technology integration which suggests that it is not all the time the technology leadership affects the technology integration. Nonetheless, encouragement from the school principals and having vision to strengthen the use of technology will contribute to the improvement to both teaching style of the teachers and learning outcomes of the students.

Moreover, the equity and citizenship advocate, visionary planner, empowering leader, and connected learner are highly correlated with overall technology integration. This is consistent with the study of Mwawasi (2014) who discovered a positive substantial association between the five components of technology leadership and technology integration. The research by Nawawi (2022) discovered that technology leadership variables are good predictors of technology integration also agree with this finding. On the contrary, Raman, et. al (2019), found that the five standards of technology leadership have no positive effect on technology integration of teachers. Among all variables, equity and citizenship advocate and over-all technology integration has the highest correlation value of .850 that signifies very strong relationship. It implies that school principals/school heads who ensure all students have access to technology and have teachers who always use technology, models digital citizenship and cultivates responsible online behavior and, use technology ethically have a significant impact on how teachers integrate technology in teaching.

Furthermore, the correlation value of visionary planner and over-all technology integration is .779 which indicates a strong significant relationship. This result suggests that school principals being visionary planners plays significant role in promoting technology integration in teaching. Moreover, the empowering leader is also a highly significant factor to technology integration as determined by the correlation value of .760. This means that being an empowering leader will contribute to teachers' technology integration. Therefore, school principals/school heads as empowering leader must build confidence of teachers, pursue professional learning and development, and inspire a culture of innovation and collaboration.

The findings also indicate that there is a significant relationship between connected learner and technology integration as specified by the correlation value of .757. Accordingly, school principals/school heads must stay up to date to new and emerging technologies, participates in online professional learning, use technology regularly, and promotes a mindset of continuous improvement for how technology can improve learning if they want to ensure technology integration.

Table 4 also illustrated that the overall technology leadership has a moderate effect to comfort with technology, beliefs and behaviors about technology use, benefits of technology use, administrative and instructional use, and general student use with a correlation value of .556, .536, .505, .554, and .528, respectively. On the other hand, technology leadership is strongly correlated with technology support and access which also obtained the highest correlation value of .688; and the lowest computed correlated value of .505 is between technology leadership and benefits of technology use.

Specifically, among all variables, the highest value of correlation obtained is .676 between connected learner and technology support and access which implies that the relationship is highly significant. This implies that connected learner is a significant predictor of technology support and access. On the other hand, the lowest value of correlation is .422 which suggests that the correlation between beliefs and behaviors about technology use and empowering leader has a weak to moderate relationship.

Table 5. Moderating Effect of Highest Educational Attainment to Technology Leadership and Technology Integration

Moderation Estimates				
	Estimate	SE	Z	P
Technology Leadership	0.67889	0.0308	22.057	< .001
Highest Educational Attainment	-0.00824	0.0190	-0.434	0.664
Technology Leadership∗ Highest Educational Attainment	0.02528	0.0350	0.723	0.470

Significant at p<0.05

Table 5 shows the moderating effect of highest educational attainment on technology leadership and technology integration. The findings (SE=0.0350, Z=-0.723, and P-value=0.470) revealed the moderating effect of highest educational attainment to technology leadership and technology integration is not highly significant. This means

that the educational attainment of the respondents, whether a bachelor's degree, a MA unit, a masters' degree, a doctorate unit, or a doctorate degree, does not moderate the effect of technology leadership of school administrators to technology integration of teachers. This also suggests that technology leadership influences and affects the technology integration of teachers in teaching regardless of the educational background. This is in line with the study of Jacinto and Samonte (2021), which revealed that neither academic rank nor educational attainment influence the self-efficacy and technology use of teachers.

Table 6. Moderating Effect of Number of Seminars and Trainings Attended to Technology Leadership and Technology Integration

Moderation Estimates				
	Estimate	SE	Z	P
Technology Leadership	0.67897	0.0298	22.801	< .001
Number of Trainings	0.00996	0.0155	0.644	0.519
Technology Leadership ✻ Numbers of Trainings and Seminars	-0.08239	0.0246	-3.344	< .001

Significant at p<0.05

Table 6 presents the moderating effect of number of ICT-related seminars and trainings to technology Leadership and technology Integration. The findings (SE = 0.0246; Z=-3.344; P.001) suggests that the moderating effect is highly significant. Therefore, numbers of trainings and seminars moderates the effect of technology leadership and technology integration. This implies that the number of ICT-related training and seminars of the respondents may strengthen or weaken the relationship of technology leadership of the school principals/school heads to technology integration of teachers.

This can be affirmed in the study of Raman and Thannimalai (2018) which implies that professional development is a deciding factor to implement technology integration. In short, the support of the administrators to professional development indirectly affects teacher's technology integration in the classroom (AlAjami, 2022). We can say that principals who inspire school vision while encouraging effective technology integration and providing continuing professional development were found to be successful in motivating teachers to integrate technology in the classroom. Furthermore, according to Omar and Noor (2020), principals are responsible in providing training opportunities and professional development for teachers to improve ICT skills. Dublar (2023) identified that teachers should be provided with training that will improve their competencies in technology. The utilization of ICT, according to Ghavifekr (2015), particularly in teaching and learning, is more about practice than theory, which is why teachers must be given time to learn and explore it. Hence, Mwawasi (2014) argued that technology leaders should have provided more effective ongoing professional development, particularly training in ICT.

Conclusion and Recommendation

Based on the findings of the study, the following conclusion can be drawn: (1) school principals/school heads display a high level of technology leadership; therefore, school principals/school heads are considered to have competencies and skills to thrive in their roles as technology leaders; (2) teachers exhibited a high level of technology integration; (3) the relationship of technology leadership and technology integration is highly significant. This means that the level of technology integration increases if school principals practice a higher level of technology leadership. Therefore, the null hypothesis that there is no significant relationship between technology leadership and technology integration is rejected; (4) highest educational attainment does not moderate the relationship of technology leadership and technology integration, so, the null hypothesis that professional development, in terms of highest educational attainment, will not moderate the relationship between technology leadership and technology integration is supported; (5) number of ICT-related trainings and seminars moderates the effect of technology leadership and technology integration, therefore, the null hypothesis is rejected.

Recommendations

In the light of the findings and conclusions drawn, the following recommendations are suggested:

1. For school administrators to continue demonstrate technology leadership in terms of being an equity and citizenship advocates, visionary planners, empowering leaders, and connected learners. They should be mindful of these roles to ensure an effective technology integration of teachers. Thus, school administrators should empower and motivate teachers to use technology in innovative ways to improve teaching, and to participate in continuous professional development to stay up to date to new technologies as well as provide professional development to teachers. Furthermore, they should strive to improve skills as technology leaders if they want to see progress and increase in technology integration.

2. For teachers to accept the importance of technology in current educational system; to promote increased use of in technology in teaching; to encourage the students to use technology for better learning; and to engage in continuous professional development that will help them develop advanced skills in technology, gain knowledge on the use of technology and be informed on the recent information about it.

3. For future researchers to consider exploring and conducting similar studies about technology leadership and technology integration. Further studies may be done to carry out more comprehensive findings.

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