

# Technological, Pedagogical, and Content Knowledge (TPACK) and 21<sup>st</sup> Century Teaching Skills of the Migrant Filipino Science Teachers in Thailand

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## ABSTRACT

This study examines the Technological, Pedagogical, and Content Knowledge (TPACK) and 21st-century teaching skills of migrant Filipino science teachers in Thailand, employing a descriptive research design. By employing purposive sampling for participant selection, data were collected through a targeted questionnaire distributed via Google Forms on social media. Analysis utilized robust statistical methods, including frequency counts, percentages, and various correlation techniques, ensuring thorough insights. The findings reveal that most migrant Filipino science teachers are young adults with bachelor's degrees and 6-10 years of teaching experience,

primarily working in government Thai bilingual schools at the elementary level. They demonstrate strong proficiency in TPACK, showcasing mastery in technological, pedagogical, and content knowledge. Additionally, their high competency in 21st-century teaching skills—such as Learning and Innovation Skills, Information and Media Skills, and Career Skills—was evident. Notably, the study revealed moderate to strong positive correlations between TPACK levels and the manifestation of these skills, underscoring the pivotal role of TPACK in enhancing teaching effectiveness. In conclusion, this research offers valuable insights into the profiles, TPACK levels, and skill competencies of migrant Filipino science teachers in Thailand, contributing to a deeper understanding of their professional strengths and potential for growth.

**Keywords:** *Technological, pedagogical, content knowledge, 21<sup>st</sup>-century teaching skills, migrant Filipino science teacher*

## INTRODUCTION

Examining the interplay of Technology, Pedagogy, and Content Knowledge (TPACK) within the framework of 21st-century science education provides critical insights into the experiences of migrant Filipino teachers in Thailand. This study invites a deeper inquiry into how technological pedagogical strategies, content expertise, and personal efficacy converge, ultimately influencing the teaching practices and effectiveness of Filipino educators as they navigate the diverse cultural and linguistic challenges in their adopted country. Teachers shoulder a myriad of essential responsibilities in the classroom, ranging from fundamental tasks to complex challenges, all of which are vital and intellectually rewarding. These responsibilities require educators to possess a solid mastery of their subject matter, a firm grasp of pedagogical principles, and proficiency in utilizing technological tools for instruction and assessment. In light of the rapid changes defining the 21st century, our education system must evolve to meet these challenges head-on. This shift has sparked a global movement to enhance teaching competencies, particularly in the realm of science education. Now more than ever, it is essential for science teachers to become proficient facilitators of learning, particularly through the strategic use of technology in delivering subject-specific content. The TPACK framework emerges as a cornerstone for developing targeted courses in science teacher education programs, ensuring they are tailored to meet the contemporary needs of teachers. Central to the TPACK framework are seven critical constructs necessary for effectively infusing technology into the teaching of content: Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). Shulman's exploration of this framework represents a landmark shift in instructional strategies that educators must embrace (Johnson et al., 2014). The issue of technology integration in educational settings has gained urgent attention globally, affecting both developed and developing nations. TPACK equips teachers with the holistic understanding necessary to effectively employ technology in their pedagogies (McGraw-Hill, 2019). While TPACK is undeniably crucial to advancing science education, many educators encounter significant obstacles when attempting to integrate it into their classroom practices. The TPACK framework articulates the essential knowledge that empowers educators to meld technological, pedagogical, and content expertise, thereby enabling the incorporation of Information and Communication Technology (ICT) into teaching and learning. UNESCO has delineated competencies necessary for developing TPACK, which include managing information design and traversing problem-solving tasks while leveraging open-ended software tools. These competencies also advocate for the alignment of subject-specific applications with student-centered teaching strategies and collaborative projects, enhancing students' profound understanding of key scientific concepts in practical, real-world contexts. In our rapidly evolving world, 21st-century skills encompass a broad spectrum of capabilities essential for both students and educators to thrive in today's complex and dynamic workforce (Campbell & Kresyman, 2015; Rajendra & Patil, 2020). The Assessment and Teaching of 21st Century Skills framework identifies these proficiencies across cognitive, collaborative, and practical dimensions. Critical skills include creativity, innovation, critical thinking, problem-solving, metacognition, effective communication, collaboration, information and ICT literacy, as well as a strong sense of citizenship and personal responsibility (van Laar et al., 2020). Despite the wealth of research aimed at identifying methods

for instilling these skills through planning and execution, a glaring gap remains regarding the lived experiences of teachers during this integration process in science education. Addressing these experiences is vital in crafting programs that serve educators' needs effectively (Schneider & Plasman, 2011, cited in Qureshi, 2017). As the world continues to embrace digitization, the urgent need for teachers, particularly migrant Filipino science educators in Thailand, to develop robust TPACK is undeniable. Their ability to navigate the unique challenges of teaching in a foreign context will be pivotal in shaping a capable, well-prepared generation of learners (Pitipornatapin & Srisakun, 2016; Kajanmanee et al., 2020; Nayar et al., 2020; Adipat, 2021).

## **METHODS**

### **Research Design**

This research design focuses on the technological, pedagogical, and content knowledge (TPACK) of migrant Filipino Science Teachers in Thailand, along with 21st-century teaching skills. The primary goal is to gain insights into how these teachers use TPACK and modern teaching methods in their science instruction within a foreign cultural context. The researcher employed qualitative data collection methods to capture the teachers' experiences in full. The design includes a comprehensive sampling plan that represents diverse perspectives among the migrant Filipino Science Teachers in Thailand. Additionally, the methodology employs careful data analysis to uncover insights that can enhance science education practices in a multicultural teaching environment.

### **Subjects of the Study**

This study examines migrant Filipino science teachers in the Northeastern region and Bangkok Metropolitan Area of Thailand. These teachers work in government, private, and international schools, teaching science from kindergarten to senior high school. According to Carranza (2024), founder of the Association of Filipino Science Teachers in Thailand, there are about 400 science teachers in the country. This number helps determine our sample size. The researcher employed simple random sampling to select respondents, gathering relevant information to address our research questions and hypotheses (Creswell & Gutterman, 2019).

### **Procedure**

An online survey questionnaire created with Google Forms was used to gather data for this study. These questionnaires are efficient for reaching large, diverse audiences and provide valuable insights (Onivefu et al., 2023). They effectively address issues like low response rates while simplifying data collection. The survey consists of three parts: demographic information, evaluation of Technological, Pedagogical, and Content Knowledge (TPACK) levels, and assessment of 21st-century teaching skills. Content validation was not necessary since it was adapted from reliable sources. The survey consists of

three parts: demographic information, an assessment of Technological, Pedagogical, and Content Knowledge (TPACK) levels, and an evaluation of 21st-century teaching skills. Content validation was not required, as the information was adapted from reliable sources.

### Treatment of the study

To gather data for this study, we will distribute a survey questionnaire to participants and analyze the responses using the Statistical Package for the Social Sciences (SPSS). First, will use frequency counts and percentiles to describe the demographic profiles of migrant Filipino science teachers in Thailand. Next, we will analyze their Technological, Pedagogical, and Content Knowledge (TPACK) using frequency counts, percentiles, modes, and the average weighted mean, summarized in the following table:

Numerical Rating	Description	Qualitative Interpretation
4.51 – 5.00	Strongly Agree	Very high level
3.51 – 4.50	Agree	High level
2.51 – 3.50	Undecided	Moderate level
1.51 – 2.50	Disagree	Low level
1.00 – 1.50	Strongly disagree	Very low level

For the third problem, we will assess 21st-century teaching skills using similar methods. The results will be presented in a separate table.

Numerical Rating	Interpretation
3.26 – 4.00	Highly Practiced/ Applied (HP/A)
2.51 – 3.25	Likely Practiced/Applied (LP/A)
1.76 – 2.50	Less Practiced/Applied (LEP/A)
1.00 – 1.75	Not Practiced/Applied (NP/A)

To examine relationships between the variables, we will use various statistical methods. For the fourth problem, we will analyze the relationship between TPACK levels and teacher profiles using ETA, Pearson Product-Moment correlation, point-biserial correlation, and Spearman rank correlation. The fifth problem will investigate the relationship between 21st-century teaching skills and teacher profiles. For the sixth problem, we will use Pearson's product-moment correlation to examine the relationship between TPACK levels and the use of 21st-century teaching skills.

## RESULTS AND DISCUSSIONS

Table 1 **Profile of Migrant Filipino Science Teachers in Thailand** (n=50)

<b>Profile</b>	<b>Category</b>	<b>Frequency</b>	<b>Percent</b>
Sex	male	25	50.0
	female	25	50.0
Age	21-30 years old	12	24.0
	31-40 years old	21	42.0
	41-50 years old	15	30.0
	51-60 years old	2	4.0
Civil Status	single	33	66.0
	married	15	30.0
	widow/ed/separated	2	4.0
Highest Educational Attainment	Bachelor's Degree	21	42.0
	With MA units	9	18.0
	MA graduate	8	16.0
	With Doctorate Degree/Units	12	24.0
Bachelor's Degree	B Secondary Education	14	28.0
	B Elementary Education	14	28.0
	BS/BSc/BA/AB	22	44.0
Years of teaching experience in Thailand	1-5 years	14	28.0
	6-10 years	18	36.0
	11-15 years	7	14.0
	16 years and above	11	22.0
Years of teaching experience	1-5 years	10	20.0
	6-10 years	16	32.0
	11-15 years	11	22.0
	16-20 years	7	14.0
	21 years and above	6	12.0
Grade Level Handled	Pre-K/Kindergarten	5	10.0
	Elementary	23	46.0
	Junior High Schol (M1-M3)	13	26.0
	Senior High School (SHS)	9	18.0
Type of School	Government Thai	9	18.0
	Government Thai Bi-Lingual	18	36.0
	Government International	2	4.0
	Private Bi-lingual	16	32.0
	International	5	10.0
Average family income	20,001-30,000Baht	20	40.0
	30,001-40,000 Baht	22	44.0
	40,001-50,000Baht	4	8.0

	50,001 Baht or more	4	8.0
Number of Affiliations/organizations	1-3	39	78.0
	4-6	7	14.0
	7 or more	4	8.0
Number of seminars and trainings attended (2020-2024)	less than 5	25	50.0
	6-10	14	28.0
	11-15	4	8.0
	16 and more	7	14.0

The profile of migrant Filipino science teachers in Thailand is characterized by several factors, including sex, age, civil status, educational attainment, years of teaching experience, grade level handled, type of school, average family income, affiliations with organizations, and seminar attendance from 2020 to 2024. **Sex.** There is an equal distribution of migrant Filipino teachers, with 50% male and 50% female. According to Novio (2019), there are approximately 16,000 to 17,000 Filipinos in Thailand; however, accurate numbers are difficult to obtain due to the country's frequent movement. **Age.** Table 1 shows that 42% are aged 31-40, 30% are aged 41-50, 24% are aged 21-30, and 4% are aged 51-60. Young adult teachers dominate, aligning with Ulla's (2018) findings. **Educational Attainment:** 21% hold bachelor's degrees, while 12% have doctorates, 18% hold master's degrees, and 16% hold master's units. Most teachers meet the minimum qualification of a bachelor's degree, but 72% hold master's degrees in English-related fields. **Years of Teaching Experience:** 36% of teachers have 6-10 years of experience in Thailand, 28% have 1-5 years, 22% have 16 years or more, and 14% have 11-15 years. Ulla (2018) notes that Filipino teachers in Thailand generally have between 5 and 17 years of experience. **Grade Level Handled:** 46% of teachers are assigned to elementary schools, 26% to junior high (M1-M3), and 18% to senior high (SHS), with 10% in pre-K/Kindergarten. **Type of School.** Most teachers work in government Thai bilingual schools (36%), followed by private bilingual schools (32%), government Thai schools (18%), and international schools (10%). **Average Family Income** 44% earn between 30,001 and 40,000 Baht, 40% earn between 20,001 and 30,000 Baht, and 16% earn either between 40,001 and 50,000 Baht or above. **Affiliations:** 78% of teachers are affiliated with 1-3 organizations, 14% with 4-6 organizations, and 8% with 7 or more. **Seminars and Training** 50% attended five or more seminars from 2020 to 2024, 28% attended 6-10, 14% attended 16 or more, and 8% attended 11-15 sessions.

Table 2

**Level of Technological, Pedagogical, and Content Knowledge of the Migrant Filipino Science Teachers in Thailand in terms of Technological Knowledge (TK) and Technological Content Knowledge (TCK)**

Technological knowledge (TK)		VH	H	M	L	VL
		5	4	3	2	1
TK1	I know how to solve my own technical problems.	12 24%	<b>28</b> <b>56%</b>	10 20%	0 0%	0 0%
TK2	I keep up with important new technologies	13 26%	<b>26</b> <b>52%</b>	11 22%	0 0%	0 0%

TK3	I know about a lot of different technologies.	10 20%	<b>28</b> <b>56%</b>	10 20%	2 4%	0%
TK4	I have the technical skills I need to use technologies.	12 24%	<b>26</b> <b>52%</b>	9 18%	2 4%	1 2%
TK5	I have had sufficient opportunity to work with various technologies.	10 20%	<b>26</b> <b>52%</b>	12 24%	2 4%	0 0%
TK6	I can learn to use new software easily on my own.	11 22%	<b>24</b> <b>48%</b>	13 26%	2 4%	0 0%

**AVERAGE WEIGHTED MEAN (AWM)=3.95/High Level**

Technological content knowledge (TCK)		VH 5	H 4	M 3	L 2	VL 1
TCK7	I know about technologies that I can use for teaching specific concepts in my subject matter.	13 26%	<b>26</b> <b>52%</b>	8 16%	3 6%	0 0%
TCK8	I know how my subject matter can be represented by applying technology.	13 26%	<b>25</b> <b>50%</b>	8 16%	4 8%	0 0%
TCK9	I know about a lot of different technologies.	14 28%	<b>24</b> <b>48%</b>	9 18%	3 6%	0 0%
TCK10	I used technological representations (i.e. multimedia, visual demonstrations, etc.) to demonstrate specific concepts in my subject matter.	15 30%	<b>25</b> <b>50%</b>	7 14%	3 6%	0 0%
TCK11	I use technology to make students observe phenomenon that would otherwise be difficult to observe in my subject matter.	13 26%	<b>24</b> <b>48%</b>	8 16%	5 10%	0 0%
TCK12	I can use technology to create and manipulate models of scientific phenomenon (e.g. animations, modelling, etc.)	11 22%	<b>27</b> <b>54%</b>	6 12%	6 12%	0 0%

**AVERAGE WEIGHTED MEAN (AWM)=3.95/High**

Note: Highest frequency count is in **bold face**.

Legend:

4.51-5.00 = *Very High (VH)*

3.51-4.50 = *High (H)*

2.51-3.50 = *Moderate (M)*

1.51-2.50 = *Low (L)*

1.00-1.50 = *Very Low (VL)*

Migrant Filipino science teachers in Thailand have a high level of technological, pedagogical, and content knowledge, with an average TK score of 3.95. In detail, 56% of teachers can solve technical problems and possess knowledge of various technologies. The average score for technological content knowledge (TCK) is also 3.95, with the highest frequency in TCK12, where teachers utilize technology to create and manipulate scientific models, such as animations.

Table 3  
**Level of Technological, Pedagogical, and Content Knowledge of the Migrant Filipino Science Teachers in Thailand in terms of Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPCK)**

<b>Technological pedagogical knowledge (TPK)</b>		<b>VH</b>	<b>H</b>	<b>M</b>	<b>L</b>	<b>VL</b>
		<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
TPK13	I can choose technologies that enhance the teaching approaches for a lesson.	11 22%	<b>27</b> <b>54%</b>	10 20%	2 4%	0 0%
TPK14	I can choose technologies that enhance students learning concepts.	10 20%	<b>29</b> <b>58%</b>	9 18%	2 4%	0 0%
TPK15	I can choose technologies that are appropriate for my teaching.	12 24%	<b>25</b> <b>50%</b>	11 22%	2 4%	0 0%
TPK16	I can apply technologies to different teaching activities.	13 26%	<b>26</b> <b>52%</b>	9 18%	2 4%	0 0%
TPK17	I can effectively manage a technology-rich classroom.	11 22%	<b>24</b> <b>28%</b>	12 24%	3 6%	0 0%
TPK18	I can use technology to help assess student learning.	13 26%	<b>23</b> <b>46%</b>	11 22%	3 6%	0 0%
<b>AVERAGE WEIGHTED MEAN (AWM)=3.93/High</b>						
<b>Technological pedagogical content knowledge (TPCK)</b>		<b>VH</b>	<b>H</b>	<b>M</b>	<b>L</b>	<b>VL</b>
		<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
TPCK19	I can teach lessons that appropriately combine my subject matter, technologies, and teaching approaches.	15 30%	<b>24</b> <b>48%</b>	10 20%	1 2%	0 0%
TPCK20	I can select technologies to use in my classroom that enhances what I teach, how I teach, and what students learn.	13 26%	<b>26</b> <b>52%</b>	10 20%	1 2%	0 0%
TPCK21	I can use strategies that combine content, technologies, and teaching approaches in my classroom.	12 24%	<b>27</b> <b>54%</b>	9 18%	2 4%	0 0%
TPCK22	I can use technology to facilitate scientific inquiry in the classroom.	0 0%	<b>22</b> <b>44%</b>	28 56%	0 0%	0 0%
<b>AVERAGE WEIGHTED MEAN (AWM)=3.88/High</b>						

Note: Highest frequency count is in **bold face**.

Legend:

4.51-5.00 = Very High (VH)                      3.51-4.50 = High (H)  
 2.51-3.50 = Moderate (M)                      1.51-2.50 = Low (L)

1.00-1.50 = *Very Low (VL)*

Table 3 presents the technological, pedagogical, and content knowledge of migrant Filipino science teachers in Thailand. The results for technological pedagogical knowledge (TPK) indicate a high level, with an average weighted mean of 3.93. The indicator with the highest frequency count is TPK14, reflecting that 29 teachers (58%) feel confident in their ability to choose technologies that enhance student learning concepts. In terms of technological pedagogical content knowledge (TPCK), the overall rating is also high, with an average weighted mean of 3.88. The indicator with the highest frequency in this category is TPCK21, where 27 teachers (54%) reported being able to use strategies that combine content, technologies, and teaching approaches in their classrooms.

Table 4  
**Summary of the Level of the Technological Pedagogical, and Content Knowledge (TPACK) of Migrant Filipino Science Teachers**

Level of TPACK	Weighed Mean	Description
Technological Knowledge (TK)	3.95	High
Technological Content Knowledge (TCK)	3.95	High
Technological Pedagogical Content (TPK)	3.93	High
Technological pedagogical content knowledge (TPCK)	3.88	High
<b>Grand Mean (TPACK)</b>	<b>3.93</b>	<b>High</b>

Table 4 summarizes the level of Technological, Pedagogical, and Content Knowledge (TPACK) of migrant Filipino science teachers, which is rated as high, with an overall weighted mean of 3.93. Notably, both technological knowledge (TK) and technological content knowledge (TCK) received the highest weighted mean of 3.95, followed closely by technological pedagogical knowledge (TPK) at 3.93 and technological pedagogical content knowledge (TPCK) at 3.88. This suggests that migrant Filipino science teachers in Thailand are well-adapted to incorporating technology into their classrooms to enhance their teaching strategies and support student learning.

Table 5  
**Degree of manifestation of the 21st-century teaching skills of the migrant Filipino Science teachers in Thailand in Learning and Innovation Skills**

<i>Creativity and Innovation Skills</i>	HP (4)	LP(3)	LEP(2)	NP(1)
LIS1. I use a wide range of idea-creation techniques, such as brainstorming.	20 40%	<b>29</b> <b>58%</b>	1 2%	0 0%
LIS2. I create new and worthwhile ideas by working on models and simulations	<b>26</b> <b>52%</b>	24 48%	0 0%	0 0%
	23	<b>27</b>	0	0

LIS3. I elaborate, refine, analyze, and evaluate my own ideas in order to improve and maximize creative efforts.	46%	<b>54%</b>	0%	0%
LIS4. I develop, implement, and communicate new ideas to others effectively.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
LIS5. I am open and responsive to new and diverse perspectives.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
LIS6. I demonstrate originality and inventiveness in work.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
LIS7. I understand that creativity and innovation is a long-term, cyclical process of small and frequent mistakes.	<b>27</b> <b>54%</b>	23 46%	0 0%	0 0%
LIS8. I act on creative ideas as a tangible and valuable contribution to the field in which innovation will occur	<b>25</b> <b>50%</b>	24 48%	1 2%	0 0%
<i>Sub Mean = 3.49 Highly Practiced</i>				

<i>Critical Thinking and problem-solving</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
LIS9. I use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation.	23 46%	<b>27</b> <b>54%</b>	0 0%	0 0%
LIS10. I use systems thinking and analyze how parts of a whole interact with each other to produce overall outcomes in complex systems.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
LIS11. I effectively analyze and evaluate evidence, arguments, claims, and beliefs.	<b>25</b> <b>50%</b>	24 48%	1 2%	0 0%
LIS12. I synthesize and make connections between information and arguments.	<b>27</b> <b>54%</b>	22 44%	1 2%	0 0%
LIS13. I interpret information and draw conclusions based on the best analysis.	<b>27</b> <b>54%</b>	22 44%	1 2%	0 0%
LIS14. I reflect critically on learning experiences and processes.	<b>27</b> <b>54%</b>	22 44%	1 2%	0 0%
LIS15. I solve different kinds of non-familiar problems in both conventional and innovative ways.	<b>26</b> <b>52%</b>	24 46%	0 0%	0 0%
LIS16. I act on creative ideas as a tangible and valuable contribution to the field in which innovation will occur	<b>26</b> <b>52%</b>	23 46%	1 2%	0 0%
<i>Sub mean =3.50 Highly Practiced</i>				

*...Continuation of Table 5*

<i>Communication and collaboration</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
LIS 17. I articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts.	<b>26</b> <b>52%</b>	24 48%	0 0%	0 0%

LIS18. I listen effectively to decipher meaning, including knowledge, values, attitudes, and intentions.	<b>27</b> <b>54%</b>	23 46%	0 0%	0 0%
LIS19. I use communication for range of purposes (e.g. to inform, instruct, motivate, and persuade).	24 48%	<b>26</b> <b>52%</b>	0 0%	0 0%
LIS20. I utilize multiple media and technologies and know how to judge their effectiveness and priority as well as assess their impact.	<b>26</b> <b>52%</b>	23 46%	1 2%	0 0%
LIS21. I communicate effectively in diverse environments (including multilingual).	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
LIS22. I collaborate with others and value the individual contributions made by each team member.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
LIS23. I demonstrate ability to work effectively and respectfully with diverse teams.	<b>27</b> <b>54%</b>	24 46%	0 0%	0 0%
LIS24. I exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
<i>Sub mean = 3.50 Highly Practiced</i>				
<b>Overall Mean= 3.50 Highly Practiced</b>				

*Note: Highest frequency count is in **bold face**.*

*Legend:*

3.26-4.00 = *Highly Practiced/Applied (HP/A)*

1.76-2.50 =

*Less Practiced/Applied (LEP/A)*

2.51-3.25 = *Likely Practiced/Applied (LP/A)*

1.00-1.75 =

*Not Practiced/Applied (NP/A)*

Table 5 highlights the remarkable mean scores for the manifestation of 21st-century teaching skills among migrant Filipino science teachers in Thailand, particularly in learning and innovation skills, which have an overall mean of 3.50. This score indicates that these educators actively implement essential skills in their classrooms. The skills are categorized into three subgroups: 1. **\*\*Creativity and Innovation Skills\*\***: sub-mean of 3.49. - (LIS1) "I can use a wide range of idea-creation techniques" – endorsed by 29 respondents (58%). - (LIS3) "I refine, analyze, and evaluate my ideas" – supported by 27 respondents (54%). 2. **\*\*Critical Thinking and Problem Solving\*\***: sub-mean of 3.50. - (LIS9) "I use various types of reasoning as appropriate" – affirmed by 27 respondents (54%). - (LIS10) "I analyze how parts of a whole interact to produce outcomes" – endorsed by 25 respondents (50%). 3. **\*\*Communication and Collaboration\*\***: sub-mean of 3.50. - (LIS19) "I use communication for a variety of purposes" – identified by 26 respondents (52%). - (LIS21) "I communicate effectively in diverse settings." These findings demonstrate a strong commitment among these teachers to develop vital teaching skills necessary for preparing their students for success in an interconnected world.

Table 6  
**Degree of manifestation of the 21st-century teaching skills of the migrant Filipino Science Teachers in Thailand in Information, Media Technology Skills**

<i>Information Literacy</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
IMTS1. I access information efficiently (time) and effectively (sources).	<b>26</b> <b>52%</b>	24 48%	0 0%	0 0%
IMTS2. I evaluate information critically and competently.	<b>26</b> <b>52%</b>	24 48%	0 0%	0 0%
IMTS3. I use information accurately and creatively for the issue or problem at hand.	24 48%	<b>26</b> <b>52%</b>	0 0%	0 0%
IMTS4. I manage the flow of information from various sources.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
IMTS5. I apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information.	<b>30</b> <b>60%</b>	20 40%	0 0%	0 0%
<i>Sub mean = 3.52 Highly Practiced.</i>				
<i>Media Literacy</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
IMTS6. I understand both how and why media messages are constructed and for what purposes.	<b>27</b> <b>54%</b>	23 46%	0 0%	0 0%
IMTS7. I examine how individuals interpret messages differently and how media can influence beliefs and behaviors.	<b>28</b> <b>56%</b>	21 42%	0 0%	0 0%
IMTS8. I have a fundamental understanding of the ethical/legal issues surrounding the access and use of media and information technologies.	<b>26</b> <b>52%</b>	24 48%	0 0%	0 0%
IMTS9. I understand and utilize the most appropriate media creation tools, characteristics, and conventions.	<b>25</b> <b>50%</b>	24 48%	1 2%	0 0%
	<b>58%</b>	42%		
<i>Sub mean =3.53 Highly Practiced</i>				
<i>ICT (Information Communications and Technology) Literacy.</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
IMTS 11. I use technology as tool to research, organize, evaluate, and communicate information.	28 <b>56%</b>	22 44%	0 0%	0 0%
IMTS12. I use digital technologies and social networks appropriately to access, manage, integrate, evaluate, and create information.	<b>30</b> <b>60%</b>	20 40%	0 0%	0 0%
<i>Sub mean =3.58 Highly Practiced</i>				
<b>Overall Mean = 3.53 Highly Practiced</b>				

*Note: Highest frequency count is in bold face.*

*Legend:*

3.26-4.00 = *Highly Practiced/Applied (HP/A)*

2.51-3.25 = *Likely Practiced/Applied (LP/A)*

1.76-2.50 =

1.00-1.75 =

*Less Practiced/Applied (LEP/A)*

*Not Practiced/Applied (NP/A)*

Table 6 outlines the information, media, and technology skills of migrant Filipino teachers, with an overall mean score of 3.53, indicating these skills are highly practiced. For information literacy, the sub-mean is 3.52, indicating a high level of application among teachers. Key indicators include (IMTS5), where 30% understand the ethical and legal issues regarding information use; (IMTS3), where 26% use information accurately and creatively; and (IMTS4), with 25% managing information flow from various sources. Media literacy has a mean score of 3.53, with indicators such as (IMTS6), where 27% understand the construction of media messages; (IMTS7), with 28% examining different interpretations of messages; and (IMTS10), where 29% effectively utilize appropriate expressions in diverse environments. Information, communications, and technology literacy scored the highest at 3.58. Key indicators include (IMTS11), where 28% use technology to research and organize information, and (IMTS12), with 30% using digital technologies appropriately for information management. Today, information is delivered through various media, providing real-time access (Li, 2003). Efficient information flow is crucial for effective communication and decision-making. Digital literacy encompasses not only access to information but also critical thinking and an understanding of the socio-cultural impacts of technology. The rapid advancement in technology and internet access has transformed teaching, learning, and communication (Hamutoğlu et al., 2020).

Table 7

**Degree of manifestation of the 21st-century teaching skills of the migrant Filipino Science Teachers in Thailand on Career and Life Skills**

<i>Flexibility and adaptability</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
CLS1. I adapt to varied roles, job responsibilities, schedules, and contexts.	<b>28</b> <b>56%</b>	22 44%	0 0%	0 0%
CLS2. I work effectively in a climate of ambiguity and changing priority.	<b>27</b> <b>54%</b>	23 46%	0 0%	0 0%
CLS3. I incorporate group input feedback into the work effectively.	<b>28</b> <b>56%</b>	22 44%	0 0%	0 0%
CLS4. I deal positively with praise, setbacks, and criticism.	<b>29</b> <b>58%</b>	21 42%	0 0%	0 0%
CLS5. I understand, negotiate, and balance diverse views and beliefs to reach workable solutions, particularly in multicultural environments.	<b>31</b> <b>62%</b>	19 38%	0 0%	0 0%
<i>Sub mean =3.57 Highly Practiced</i>				
<i>Initiative and self-direction</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
CLS6. I set goals with tangible and intangible success criteria.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
CLS7. I balance tactical (short-term) and strategic (long-term) goals.	23 46%	<b>27</b> <b>54%</b>	0 0%	0 0%
CLS8. I utilize time and manage workload efficiently.	<b>26</b> <b>52%</b>	24 48%	0 0%	0 0%
	<b>28</b>	22	0	0

CLS9. I monitor, define, prioritize, and complete tasks without direct oversight.	<b>56%</b>	44%	0%	0%
	<b>27</b>	23	0	0
CLS10. I am self-directed learner.	<b>54%</b>	46%	0%	0%
	<b>26</b>	24	0	0
CLS11. I go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning	<b>52%</b>	48%	0%	0%
	<b>27</b>	23	0	0
CLS12. I understand that creativity and innovation is a long-term, cyclical process of small and frequent mistakes.	<b>54%</b>	46%	0%	0%
	<b>26</b>	24	0	0
CLS13. I act on creative ideas as a tangible and valuable contribution to the field in which innovation will occur	<b>52%</b>	48%	0%	0%
<i>Sub mean=3.52 Highly Practiced</i>				
<i>Social and cross – cultural interaction</i>				
	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
CLS.14 I know when it is appropriate to listen and when to speak.	<b>30</b>	20	0	0
	<b>60%</b>	40%	0%	0%
CLS15. I conduct myself in a respectable, professional manner.	<b>30</b>	20	0	0
	<b>60%</b>	40%	0%	0%
CLS16. I respect cultural differences and work effectively with people from a range of social and cultural backgrounds.	<b>27</b>	23	0	0
	<b>54%</b>	46%	0%	0%
CLS17. I respond open-mindedly to different ideas and values.	<b>27</b>	23	0	0
	<b>54%</b>	46%	0%	0%
CLS.18 I leverage social and cultural differences to create new ideas and increase both innovation and quality of work.	<b>28</b>	22	0	0
	<b>56%</b>	44%	0%	0%
<i>Sub mean =3.57 Highly Practiced</i>				
<i>...Continued on Table 8</i>				

Table 8

**Degree of manifestation of the 21st-century teaching skills of the migrant Filipino Science Teachers in Thailand on Career and Life Skills**

<i>Productivity and accountability</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
CLS19. I set and meet goals, even in the face of obstacles and competing pressure.	<b>27</b>	23	0	0
	<b>54%</b>	46%	0%	0%
CLS20. I prioritize, plan, and manage work to achieve the intended result.	<b>29</b>	21	0	0
	<b>58%</b>	42%	0%	0%
CLS21. I work positively and ethically.	<b>25</b>	25	0	0
	<b>50%</b>	50%	0%	0%
CLS22. I multi-task, manage time and projects effectively.	<b>28</b>	22	0	0
	<b>56%</b>	44%	0%	0%
	<b>27</b>	23	0	0

CLS23. I participate actively, as well as I am reliable and punctual.	<b>54%</b>	46%	0%	0%
CLS24. I present oneself professionally and with proper etiquette.	<b>29</b> <b>58%</b>	21 42%	0 0%	0 0%
CLS25. I am accountable for results.	23 46%	<b>27</b> <b>54%</b>	0 0%	0 0%

*Sub mean = 3.54 Highly Practiced*

<i>Leadership and responsibility</i>	<b>HP (4)</b>	<b>LP(3)</b>	<b>LEP(2)</b>	<b>NP(1)</b>
CLS26. I use interpersonal and problem-solving skills to influence and guide other toward a goal.	23 46%	<b>27</b> <b>54%</b>	0 0%	0 0%
CLS27. I leverage the strengths of other accomplish a common goal.	<b>25</b> <b>50%</b>	<b>25</b> <b>50%</b>	0 0%	0 0%
CLS28. I inspire others to reach their very best via example and selflessness.	24 48%	<b>26</b> <b>52%</b>	0 0%	0 0%
CLS29. I demonstrate integrity and ethical behavior in using influence and power.	<b>25</b> <b>50%</b>	24 48%	1 2%	0 0%
CLS30. I act responsibly with the interests of the larger community in mind.	<b>25</b> <b>50%</b>	23 46%	2 4%	0 0%
CLS31. I help teachers develop their abilities to use various strategies (such as formative assessments) to reach diverse students and create environments that support differentiated teaching and learning.	<b>26</b> <b>52%</b>	24 48%	0 0%	0 0%
CLS32. I encourage knowledge sharing among communities of practitioners using face-to-face, virtual, and blended communications.	<b>26</b> <b>52%</b>	23 46%	1 2%	0 0%

*Sub mean = 3.49 Highly Practiced*

**Overall Mean=3.53 Highly Practiced**

*Note: Highest frequency count is in bold face.*

*Legend:*

3.26-4.00 =	<i>Highly Practiced/Applied (HP/A)</i>	1.76-2.50 =	<i>Less Practiced/Applied (LEP/A)</i>
2.51-3.25 =	<i>Likely Practiced/Applied (LP/A)</i>	1.00-1.75 =	<i>Not Practiced/Applied (NP/A)</i>

Tables 7 and 8 outline the career and life skills of migrant Filipino science teachers as essential 21st-century skills. The overall mean score of 3.53 indicates that these skills are highly practiced, with specific scores as follows: - Flexibility and adaptability: 3.57 - Initiative and self-direction: 3.52 - Social and cross-cultural interaction: 3.57 - Productivity and accountability: 3.54 - Leadership and responsibility: 3.49 For flexibility and adaptability, the statement "I deal positively with praise, setbacks, and criticism" received the highest response, with 29 (58%). In initiative and self-direction, key statements included "I monitor, define, prioritize, and complete tasks without direct oversight" (28, 56%) and "I am a self-directed learner" (27, 54%). Additionally, two likely practiced indicators are "I set goals with tangible and intangible success criteria" (25, 50%) and "I balance tactical and strategic goals" (27, 54%).

Table 9  
**Summary of the Degree of Manifestation of the 21<sup>st</sup>-Century Teaching Skills of Migrant Filipino Teachers**

21 <sup>st</sup> Century Teaching Skills	Weighted Mean	Description
A. Learning and Innovation Skills (LIS)	3.50	<i>Highly Practiced</i>
B. Information, Media Technology and Skills (IMTS)	3.53	<i>Highly Practiced</i>
C. Career and Life Skills (CLS)	3.53	<i>Highly Practiced</i>
<b>Grand Mean (Degree of Manifestation)</b>	<b>3.52</b>	<b><i>Highly Practiced</i></b>

The study assessed the 21st-century teaching skills of migrant Filipino teachers in three areas: Learning and Innovation Skills, Information, Media, and Technology Skills, and Career and Life Skills. The results indicated high proficiency, with scores ranging from 3.50 to 3.53, categorizing them as “Highly Practiced.” The overall score of 3.52 confirms their firm grasp of essential teaching competencies. This supports research that effective teaching in the 21st century requires diverse skills beyond traditional knowledge. Teachers must embody critical thinking, communication, collaboration, and creativity to help students develop these abilities. The migrant Filipino teachers in this study appear well-prepared to foster 21st-century learning in their classrooms.

Table 10  
**Significant Relationship Between Level of Technological Pedagogical and Content Knowledge of Migrant Filipino Science teachers in Thailand and their profile level of Manifestation of 21st Century Skills**

Profile	Eta( $\eta$ )	Eta ( $\eta$ ) squared	Strength of Relationship
civil status	0.131	0.017	S
BS Degree	0.165	0.027	S
Type of School	0.477	0.228	M

*Legend for  $\eta$  value:*

*Negligible (N) 0.00-.09    Small (S)= 0.10-.30    Medium (M) = 0.31-0.50    Large (L) = 0.51-1.00*

Table 10 examines the relationship between the Technological Pedagogical and Content Knowledge (TPACK) of migrant Filipino science teachers in Thailand and their profiles concerning 21st-century skills—Eta ( $\eta$ ) values and Eta squared measure these relationships. Civil status has an Eta value of 0.131 and Eta squared of 0.017, indicating a small influence on 21st-century skills. Educational attainment, specifically holding a Bachelor’s Degree (BS), shows an Eta value of 0.165 and Eta squared of 0.027, reflecting a similarly small impact. In contrast, the type of school has a more substantial influence, with an Eta value of 0.477 and an Eta squared of 0.228, categorized as medium strength. This suggests that the school environment—whether government or private—significantly affects teachers' abilities to utilize

modern teaching practices. Overall, civil status and educational background have minor effects on 21st-century skills, while the type of school is a crucial factor in shaping teachers' professional development.

Table 11  
**Significant Relationship Between Level of Technological Pedagogical and Content Knowledge of Migrant Filipino Science teachers in Thailand and their profile**

Profile	Correlation Coefficient	TPACK
Sex <sup>a</sup>	r	-0.053
	Sig.	0.716
Age <sup>b</sup>	r	-0.066
	Sig.	0.647
Highest Educational Attainment <sup>c</sup>	r	-0.077
	Sig.	0.595
Years of teaching experience in Thailand <sup>b</sup>	r	0.014
	Sig.	0.921
Years of teaching experience <sup>b</sup>	r	-0.056
	Sig.	0.701
Average family income <sup>b</sup>	r	0.063
	Sig.	0.665
number of seminars and trainings attended(2020-2024) <sup>b</sup>	r	0.005
	Sig.	0.975
Grade Level Handled <sup>c</sup>	r	-0.004
	Sig.	0.981
Number of affiliations or organizations <sup>b</sup>	r	-0.060
	Sig.	0.678

<sup>a</sup> Point Biserial Correlation; <sup>b</sup> Pearson r correlation; <sup>c</sup> Spearman rank correlation

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

\*. Correlation is significant at the 0.05 level (2-tailed).

Table 11 examines the relationship between demographic factors and Technological Pedagogical and Content Knowledge (TPACK) among migrant Filipino science teachers in Thailand. The results indicate no significant correlations with sex ( $r = -0.053$ ), age ( $r = -0.066$ ), educational attainment ( $r = -0.077$ ), years of teaching ( $r = 0.014$ ), and other demographic factors. These findings suggest that TPACK may be influenced more by teaching practices and school support than by demographic characteristics. This aligns with previous research emphasizing the complexity of teacher knowledge, highlighting the need for targeted professional development (Han et al., 2018; Zheng et al., 2020). In summary, while TPACK is crucial for effective teaching, the current results show that demographic factors do not significantly correlate with TPACK levels among these educators. Future research should investigate additional factors that influence professional development.

Table 12  
**Relationship Between the Degree of Manifestation of the 21st-Century Teaching Skills of the Migrant Filipino Science teachers in Thailand and their Profile**

Profile		<i>LIS</i>	<i>IMTS</i>	<i>CLS</i>	Degree of Manifestation
sex	r	0.066	0.080	0.097	0.083
	Sig.	0.651	0.579	0.501	0.567
age	r	0.270	0.210	0.223	0.241
	Sig.	0.058	0.144	0.120	0.092
Highest Educational Attainment	r	0.083	0.043	0.028	0.039
	Sig.	0.566	0.769	0.848	0.790
Years of teaching experience in Thailand	r	0.250	0.189	0.225	0.226
	Sig.	0.080	0.190	0.116	0.114
Years of teaching experience	r	0.268	0.226	0.225	0.245
	Sig.	0.060	0.115	0.117	0.086
Average family income	r	<b>.310*</b>	0.247	0.252	0.276
	Sig.	<b>0.029</b>	0.084	0.077	0.053
number of seminars and trainings attended(2020-2024)	r	0.234	0.245	<b>.293*</b>	0.263
	Sig.	0.102	0.087	<b>0.039</b>	0.065
Grade Level Handled	r	0.266	<b>.305*</b>	<b>.340*</b>	<b>.314*</b>
	Sig.	0.062	<b>0.031</b>	<b>0.016</b>	<b>0.027</b>
Number of affiliations or organizations	r	0.255	0.174	0.170	0.203
	Sig.	0.074	0.226	0.237	0.157

Legend: <sup>a</sup> Point Biserial Correlation; <sup>b</sup> Pearson r correlation; <sup>c</sup> Spearman rank correlation

*Learning and Innovation Skills (LIS); Information, Media Technology and Skills (IMTS); Career and Like Skills (CLS)*

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

\**. Correlation is significant at the 0.05 level (2-tailed).*

Table 12 illustrates the relationship between the profiles of migrant Filipino science teachers and their 21st-century teaching skills. Key findings include: 1. Age: A moderate correlation exists between age and Learning and Innovation Skills (LIS) ( $r = 0.270$ ,  $p = 0.058$ ), suggesting older teachers may demonstrate better skills due to their experience (Harris & Hofer, 2014). 2. Average Family Income: A significant correlation exists with LIS ( $r = 0.310$ ,  $p = 0.029$ ), suggesting that higher income may enhance access to educational resources (Gonzalez, 2021). 3. Professional Development: The number of seminars and

trainings attended correlates with Information, Media Technology and Skills (IMTS) ( $r = 0.245$ ) and Career and Life Skills (CLS) ( $r = 0.293$ ), highlighting the importance of continuous training (Darling-Hammond et al., 2017). 4. Grade Level Handled: Notable correlations with skills are observed (LIS  $r = 0.266$ , IMTS  $r = 0.305$ , CLS  $r = 0.340$ ), indicating that teaching higher grades necessitates advanced skills (Bennett & Maton, 2010). 5. Teaching Experience in Thailand: Years of teaching experience in Thailand show a positive correlation with LIS ( $r = 0.250$ ), suggesting that familiarity with the local context enhances skills (Nguyen, 2023). Socioeconomic status, age, and professional development significantly impact teaching skills. Further research is needed to explore these factors over time in diverse educational settings.

Table 13  
**Relationship Between the Degree of Manifestation of the 21st-Century Teaching Skills of the Migrant Filipino Science teachers in Thailand and their Profile**

<b>Profile</b>	<b>Eta(<math>\eta</math>)</b>	<b>Eta squared (<math>\eta^2</math>)</b>	<b>Strength of Relationship</b>
<i>Learning and Innovation Skills (LIS)</i>			
civil status	0.101	0.010	S
BS Degree	0.144	0.021	S
Type of School	0.494	0.244	M
<i>Information, Media Technology and Skills (IMTS)</i>			
civil status	0.180	0.032	S
BS Degree	0.215	0.046	S
Type of School	0.455	0.207	M
<i>Career and Like Skills (CLS)</i>			
civil status	0.110	0.012	S
BS Degree	0.125	0.016	S
Type of School	0.455	0.207	M
<i>Degree of Manifestation of 21<sup>st</sup> Century Skills</i>			
civil status	0.131	0.017	S
BS Degree	0.165	0.027	S
Type of School	0.477	0.228	M

*Legend for  $\eta$  value:*

*Negligible (N) 0.00-.09    Small (S) = 0.10-.30    Medium (M) = 0.31-0.50    Large (L) = 0.51-1.00*

The table 13 analyzes the relationship between 21st-century teaching skills and the profiles of migrant Filipino science teachers in Thailand, focusing on Learning and Innovation Skills (LIS), Information Media and Technology Skills (IMTS), and Career and Life Skills (CLS). It considers the teachers' civil status, educational background (Bachelor of Science degree), and school type. For LIS, civil status (Eta = 0.101) and the Bachelor's degree (Eta = 0.144) show small relationships, while school type has a medium impact (Eta = 0.494). In IMTS, civil status (Eta = 0.180) and the Bachelor's degree (Eta =

0.215) also have small relationships. School type remains significant (Eta = 0.455). For CLS, civil status (Eta = 0.110) and the Bachelor's degree (Eta = 0.125) show small relationships, with school type again having a medium influence (Eta = 0.455). Overall, civil status and educational background have limited effects on 21st-century skills, while school type is a major factor influencing teachers' abilities to demonstrate these skills.

Table 14  
**Relationship Between the Level of Technological Pedagogical and Content Knowledge and the Degree of Manifestation of the 21st-century Teaching Skills of the Migrant Filipino Science Teachers in Thailand**

		LIS	IMTS	CLS	Degree of Manifestation of 21 <sup>st</sup> Century Skill
TPACK Level	Pearson Correlation	.549**	.526**	.563**	<b>.558**</b>
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

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

\**. Correlation is significant at the 0.05 level (2-tailed).*

The table assesses the relationship between Technological Pedagogical and Content Knowledge (TPACK) and 21st-century teaching skills among migrant Filipino science teachers in Thailand, focusing on Learning and Innovation Skills (LIS), Information, Media, and Technology Skills (IMTS), and Career and Life Skills (CLS). The Pearson correlation for LIS is 0.549, indicating a moderate positive relationship with TPACK ( $p = 0.000$ ). The correlation for IMTS is 0.526, also significant ( $p = 0.000$ ), showing that higher TPACK correlates with improved IMTS. For CLS, the correlation is 0.563, suggesting a moderate to strong relationship, with a significant p-value of 0.000. Overall, the correlation with 21st-century skills is 0.558, again significant ( $p = 0.01$ ). In summary, higher TPACK levels are linked to better demonstration of essential teaching skills, indicating that enhancing TPACK can significantly improve teaching effectiveness among these teachers.

Table 1 provides an overview of migrant Filipino science teachers in Thailand, highlighting key factors such as sex, age, educational attainment, years of teaching experience, grade level taught, type of school, average family income, and seminar attendance from 2020 to 2024. **\*\*Sex:\*\*** The gender distribution is equal, with 50% male and 50% female. **\*\*Age:\*\*** Ages of teachers are primarily between 31-40 (42%), followed by 41-50 (30%), 21-30 (24%), and 51-60 (4%). **\*\*Educational Attainment:\*\*** Among the teachers, 21% hold bachelor's degrees, 12% have doctorates, 18% possess master's degrees, and 16% have master's units. Notably, 72% hold master's degrees in English-related fields. **\*\*Years of Teaching Experience:\*\*** 36% have 6-10 years, 28% have 1-5 years, 22% have 16 or more years, and 14% have 11-15 years of experience. **\*\*Grade Level Taught:\*\*** 46% teach in elementary schools, 26% in junior high, 18% in senior high, and 10% in pre-K/Kindergarten. **\*\*Type of School:\*\*** Most work in government Thai bilingual schools (36%), followed by private bilingual schools (32%) and government Thai schools (18%). **\*\*Average Family Income:\*\*** 44% earn 30,001-40,000 Baht, 40% earn 20,001-30,000 Baht, and 16% earn

over 40,000 Baht. **\*\*Affiliations:\*\*** 78% are affiliated with 1-3 organizations, while 14% belong to 4-6 organizations. **\*\*Seminars and Training:\*\*** 50% attended five or more seminars from 2020 to 2024.

Table 2 shows a high level of technological, pedagogical, and content knowledge among these teachers, with an average technological knowledge (TK) score of 3.95.

Table 3 further highlights a high level of technological pedagogical knowledge (TPK) with an average score of 3.93, where 58% of teachers feel confident in choosing technologies that enhance learning.

Table 4 summarizes the overall Technological, Pedagogical, and Content Knowledge (TPACK) rating as high, with a mean score of 3.93, indicating effective integration of technology in teaching.

Table 5 highlights the manifestation of 21st-century teaching skills among these teachers, with an overall mean score of 3.50 in learning and innovation skills, specifically in creativity and innovation, critical thinking and problem-solving, and communication and collaboration.

Table 6 presents the information, media, and technology skills of migrant Filipino teachers, with a high mean score of 3.53. Information literacy has a sub-mean of 3.52, with 30% understanding ethical issues (IMTS5), 26% using information creatively (IMTS3), and 25% managing information from various sources (IMTS4). Media literacy scored 3.53, with 27% understanding media construction (IMTS6), 28% examining interpretations (IMTS7), and 29% using expressions effectively (IMTS10). Information, communications, and technology literacy scored the highest at 3.58, with 28% using technology for research (IMTS11) and 30% applying digital tools for information management (IMTS12). Digital literacy encompasses critical thinking and an understanding of the socio-cultural impacts of technology.

Tables 7 and 8 highlight that the career and life skills of migrant Filipino science teachers have an overall mean score of 3.53, with specific scores: - Flexibility and adaptability: 3.57 - Initiative and self-direction: 3.52 - Social interaction: 3.57 - Productivity: 3.54 - Leadership: 3.49 The highest response in flexibility was for handling praise and criticism positively (58%). In initiative, key statements included self-monitoring tasks (56%) and being a self-directed learner (54%).

Table 9 reveals that 21st-century teaching skills scores between 3.50 and 3.53, indicating high proficiency. The overall mean of 3.52 confirms the teachers' competence in critical skills necessary for student development.

Table 10 examines the relationship between Technological Pedagogical and Content Knowledge (TPACK) and teachers' profiles. Civil status has a negligible impact ( $H^2 = 0.131$ ), educational attainment shows a slight effect ( $H^2 = 0.165$ ), while the type of school has a significant influence on skills ( $H^2 = 0.477$ ).

Table 11 investigates demographic factors related to TPACK. No significant correlations were found with sex, age, education, or years of teaching, indicating that teaching practices and school support

are more influential than demographics. Thus, while TPACK is vital for effective teaching, demographic factors do not significantly affect it.

Table 12 illustrates the relationship between the profiles of migrant Filipino science teachers and their 21st-century teaching skills. Key findings include: 1. **Age**: A moderate correlation with Learning and Innovation Skills (LIS) ( $r = 0.270$ ,  $p = 0.058$ ), indicating that older teachers may possess better skills due to their experience. 2. **Average Family Income**: Significant correlation with LIS ( $r = 0.310$ ,  $p = 0.029$ ), suggesting higher income improves access to resources. 3. **Professional Development**: Attendance at training is correlated with Information, Media, and Technology Skills (IMTS) ( $r = 0.245$ ) and Career and Life Skills (CLS) ( $r = 0.293$ ), highlighting the need for ongoing training. 4. **Grade Level Handled**: Correlations with LIS ( $r = 0.266$ ), IMTS ( $r = 0.305$ ), and CLS ( $r = 0.340$ ) indicate that teaching higher grades requires advanced skills. 5. **Teaching Experience in Thailand**: Positive correlation with LIS ( $r = 0.250$ ), suggesting familiarity enhances skills. Overall, socioeconomic status, age, and professional development have a significant impact on teaching skills, warranting further research.

Table 13 analyzes the relationship between 21st-century skills and the profiles of migrant Filipino science teachers in Thailand, focusing on civil status, educational background (Bachelor of Science), and school type. For LIS, civil status ( $\eta^2 = 0.101$ ) and Bachelor's degree ( $\eta^2 = 0.144$ ) show small relationships, while school type ( $\eta^2 = 0.494$ ) has a medium impact. In IMTS and CLS, school type remains significant. Overall, civil status and education have limited effects, while school type is a major influencing factor.

Table 14 assesses the relationship between Technological Pedagogical and Content Knowledge (TPACK) and 21st-century teaching skills. The Pearson correlation coefficients for LIS, IMTS, and CLS are 0.549 ( $p = 0.000$ ), 0.526 ( $p = 0.000$ ), and 0.563 ( $p = 0.000$ ), respectively. Overall, the correlation with 21st-century skills is 0.558 ( $p = 0.01$ ). In conclusion, higher TPACK levels are associated with improved teaching skills, suggesting that enhancing TPACK can enhance effectiveness.

## CONCLUSIONS

The study shows that migrant Filipino science teachers in Thailand exhibit significant correlations between their profiles and 21st-century teaching skills. Factors such as age, family income, professional development, and teaching experience have a positive influence on skills in learning, technology, and career development. Additionally, the type of school has a significant impact on teachers' effectiveness in utilizing modern teaching methods.

## RECOMMENDATION

To enhance the effectiveness of migrant Filipino science teachers and improve student learning outcomes in Thailand, several recommendations can be implemented. First, ongoing professional development should be provided, with a focus on integrating technology and innovative teaching methods.

Additionally, it is important to support higher-income families by implementing policies that increase income and access to resources, including scholarships for continuing education. Professional development initiatives should also be tailored to meet the specific needs of teachers based on the grade levels they teach. Fostering a collaborative culture within schools is essential for sharing best practices and supporting one another. Lastly, conducting longitudinal studies will help to understand the evolving impact of these factors on teaching practices. By adopting these strategies, the overall effectiveness of education can be significantly improved.

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