THAI TEACHERS' SELF-EFFICACY TOWARDS EDUCATIONAL TECHNOLOGY INTEGRATION

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Abstract: The use of educational technology in classrooms is reportedly low, with teachers often lacking confidence in their ability to integrate technology in learning environments. This paper is a summary of a thesis research study that aimed to assess determinants of in-service teachers' self-efficacy towards educational technology integration, such as the influence and convergence of perceptions of digital competence, performance outcome expectations, social outcome expectations and IT support. Data were collected from 87 primary and secondary schools in the Pakchong region of Nakhon Ratchasima over a four-month period. The research instrument comprised of a 37 question Likert scale survey distributed to participants via an online messaging application to assess teachers' opinions. Data was collected using Google Forms and subjected to multiple linear regression analysis using SPSS software. The results of this study supported previous findings that digital competence, outcome expectations, and IT support do influence teachers' self-efficacy towards technology integration. The individually significant predictors of self-efficacy towards educational technology integration were social outcome expectations, problem solving (a sub-variable of digital competence), performance outcome expectations, and IT support. The findings of this research afford stakeholders guidance in developing an appropriate and supportive work culture to improve teachers' self-efficacy towards educational technology integration. This research also serves to establish baseline teacher technology standards, examine the influence of psychosocial barriers to technology integration, and align training and IT support with staff needs.

Keywords: self-efficacy, digital competence, performance outcome expectations, social outcome expectations, educational technology integration

1. INTRODUCTION

The use of educational technology in the classroom is reportedly low and has a negative impact on student learning outcomes. Teachers are not using technology to the extent required, or perhaps not equipped with the skills for successful integration, in fact some are not even using technology at all. The digital habits and competencies of teachers are thus cause for concern, not only in relation to teachers themselves but for the vicarious impact they have on students and co-workers too.

Teachers are preparing students for jobs that may not yet exist in a world ever more reliant on digital technology and data. The continuous promotion of digital competence standards coupled with the pursuit of lifelong learning must become institutional norms. As the ongoing digital revolution continues to disrupt learning, it is imperative that schools embrace the transcendent use of technology to push the limits of educational outcomes.

The purpose of this study was to assess teachers' perceptions of their digital competency, how they view outcomes of using technology, if they feel its use increases social status or appreciation among workplace peers, whether they feel adequately supported in a technological sense, and any subsequent impact the aforementioned may have on their self-efficacy towards educational technology integration.

This study may serve as a baseline template for monitoring teachers' self-efficacy, digital competence, and educational technology integration over time in support of in-service training and development. It may also aid stakeholders in nurturing a supportive work culture, afford active monitoring of teachers' skills and attitudes, and provide data for incentivizing continuous professional development.

The focus of this study was Thai-native teachers in a semi-rural region of Thailand with many small, and technologically limited schools. While previous studies that informed this research looked at pre-service teachers, this study considered the issue from an in-service teacher perspective.

1.1 Research Question

Do teachers' perceptions of digital competence, performance outcome expectations, social outcome expectations, and IT support influence their self-efficacy towards educational technology integration?

1.2 Research Objectives

1. To assess the influence of teachers' perceptions of digital competence, performance outcome expectations, social outcome expectations, and IT support on their self-efficacy towards educational technology integration.
2. To define a basic standard of digital competence and technological conscientiousness, offering a rudimentary starting point for institutions to actively monitor and thus improve educational technology integration.

1.3 Significance

The perception of outcomes, opinions of colleagues, availability of support, and confidence in one's digital skills and ability for technology integration are a major point of convergence that can enable or obstruct the necessary use of learning technologies. Teachers' attitudes and behaviors also have a vicarious impact on students, which is an important subtext of this research.

Establishing and sustaining a baseline digital skills standard empowers teachers to capitalize on available resources. It may also afford them confidence to overcome obstacles and creatively engage with technology in the classroom. Having confident, digitally skilled, and creative educators who are persistent even when faced with infrastructural difficulties and resource constraints is an essential prerequisite for optimal student exposure to technology use and understanding.

1.4 Scope

This study focused on the determinants of self-efficacy towards educational technology integration of in-service teachers at both primary and secondary level schools in the region of Pakchong, Nakhon Ratchasima. It took the form of an online self-reported 5-point Likert scale survey completed within a four-month timeframe. In total, there were eighty-seven schools included in this research with approximately 1,152 teachers employed therein.

1.5 Limitations

As this survey involved the self-reporting of perceptions and abilities, some participants may have answered in a manner that they deemed socially desirable or in accordance with the will of their supervisors or institutions. Teachers with a positive attitude towards technology may

have been over-represented as the survey took the form of a distributed online link, utilizing technology as a means of distribution. The subjectivity of self-reported data is also a factor that should be considered.

2. LITERATURE REVIEW

A brief overview of research constructs and framework (**Figure 1**) to follow.

2.1 Self-Efficacy Towards Educational Technology Integration

Self-efficacy towards educational technology integration refers to the measure of confidence in one's ability to use educational technology in a learning environment. The 'integration' aspect of educational technology integration is the responsible and ethical use of various technologies in the approach to teaching (Niederhauser & Perkman, 2008).

Bandura (as cited in Raphael & Mtebe, 2017, p. 197) defines self-efficacy "as the strength of one's beliefs in one's own ability to complete tasks and reach certain goals". In the case of teachers, those who have high technology self-efficacy are likely to believe that they have the necessary skills to integrate instructional technology in the classroom (Perkmen & Surmelioglu, 2016, p. 88).

Research conducted by Govender & Govender (2009, p. 162) supports this assertion. Their study of 1,237 educators across 93 schools determined that educators' attitudes towards ICT and their ICT competency levels related to their self-efficacy beliefs concerning ICT integration. Moreover, Lemon & Garvis (2015, p. 16) reported that teachers bring with them "their self-efficacy, confidence, and competence into the profession and influence both colleagues they work with and students they teach".

To summarize, self-efficacy can explain variation in teachers' digital competence and technology integration in a learning environment, while also having vicarious influence on student learning. Hatlevik & Hatlevik (2018, p. 85) concluded that a more general ICT self-efficacy is an important prerequisite for developing ICT self-efficacy for instructional purposes, and thus an important consideration of this study.

2.2 Digital Competence

Digital competence is the cornerstone and precursor to technology integration and is also impacted by self-efficacy beliefs. A transversal key competence, it is one of 8 key competencies required for lifelong learning. Digital competence is a conversion of literacies, in this case information and data literacy, communication and collaboration, digital content creation, safety, and problem solving (Vuorikari, Punie, Carretero, & Van Den Brande, 2016). Johannesen, Øgrim, & Giæver (2014, p. 306) described digitally competent teachers as those "with digital confidence and a digital repertoire that can form a basis for making educated choices about when and how technology should be integrated into educational practice".

Research shows a strong association between perception of digital competency and instructional efficacy, suggesting that "positive attitudes towards ICT are positively correlated with teachers' levels of experience with computer technology, and are recognized as a necessary condition for the effective use of ICT in the classroom" (Elstad & Christophersen, 2017, p. 4). Hatlevik & Hatlevik (2018, p. 80) also noted that teachers' general perception of their own ICT skills is a necessary determinant of self-efficacy in using ICT for instructional purposes. Teachers who have a high level of personal digital competence are more likely to feel confident in using technology in a professional and educational setting. Jones (as cited in

Buabeng-Andoh, 2012, p. 139) reported that "teachers' competence relates directly to confidence, and also relates to their perceptions of their ability to use computers in the classroom".

A 2015 study identified ICT competency as a teacher training deficiency in Thailand's education system and cited a need for better practical skills and understanding towards ICT in general (Akarawang, Kidrakran, & Nuangchalerm, 2015, p. 1). Snoeyink and Ertmer (as cited in Hew & Brush, 2006, p. 238) found that "teachers did not see the value of technology integration until they had developed basic skills", and that "focusing on technology knowledge and skills is clearly important because technology integration cannot occur if the teacher lacks the knowledge and skills to operate computers and software".

Similar recurring themes appear throughout the literature i.e. how lack of knowledge and experience with technology impacts on self-efficacy and in turn educational technology integration. Personal digital competence is therefore a 'gateway' and precursor to professional digital competence. In a summary of studies that looked at teachers' digital competence, Lakkala, Ilomäki, & Kantosalo (2011, p. 2) concluded that "present and future teachers must be prepared to provide technology-supported learning opportunities for their students and, therefore need to have adequate ICT skills and digital competence themselves".

2.3 Performance Outcome Expectations

Performance outcome expectations refers to the degree to which individuals believe that using a certain technology will enable them to accomplish certain tasks (Niederhauser & Perkman, 2008). Beliefs regarding the outcomes of technology-related actions can serve as motivational and impact positively on technology integration. While the development of skills and self-efficacy is essential to integration, it is vital that teachers also recognize the value of integrating technology into their instructional practice. Thus, outcome expectations are an important aspect of motivation and goal setting (Lippke, 2017).

Beliefs can shape behavior in terms of how teachers use technology and previous research has demonstrated the role of beliefs in predicting motivation to use technology in the classroom. Schrum (in Lemon & Garvis, 2015, p. 4) observed that "in order to adopt technology teachers need to be reasonably convinced that technology will improve teaching and learning". Garcia-Penalvo & Garcia-Carrasco (as cited in Hernández-Ramos et al, 2014, p. 510) suggested that "incorporating technologies into teaching is conditioned by what teachers think and by what expectations they have regarding the use of these resources". Pajares (as cited in Niederhauser & Perkmen, 2010, p. 437) agreed that "unless people believe that their actions will have the desired consequences, they have little incentive to engage in those actions".

Earlier research also showed a moderate correlation between self-efficacy and outcome expectations, suggesting that those with high educational technology self-efficacy tend to expect positive outcomes when using it in a classroom environment (Sahin, 2008, Perkman, 2014, as cited in Perkmen & Surmelioglu, 2016, p. 88). Performance outcome expectations was also the second most important predictor of self-efficacy towards educational technology integration in the research conducted by Raphael & Mtebe (2017).

2.4 Social Outcome Expectations

This construct refers to the influence of peers on an individual's perception of the use of technologies in teaching. Social outcome expectations are based on the belief that the effective use of technology would warrant positive acknowledgement from one's peers, serving as motivation to pursue a course of action to that end (Niederhauser & Perkman, 2008).

Having high technology self-efficacy would mean that teachers are likely to believe they have the necessary skills for effective use, while having positive outcome expectations would mean that teachers would expect the use of educational technologies to have positive outcomes (Perkmen & Surmelioglue, 2016, pp. 88-94). Pynoo (as cited in Baydas, & Goktas, 2016, p. 6) also endorsed the importance of social outcome expectations and stated that "teachers' use of IT in lessons can be as a result of the impressions they have received from colleagues, administrators, and students".

The culture of an institution may also play an essential role in influencing technology integration, as "the surrounding environment can serve to motivate teachers to utilize technology in their teaching" (Burden & Hopkins, Kim et al, Zhou & Xu in DeGregorio & Liston, 2018, p. 113).

2.5 IT Support

IT support refers to the availability of reliable IT support services to teachers in the workplace (Raphael & Mtebe, 2017). Support can be multi-faceted, ranging from training opportunities, to technical support during technological failure. As the strongest predictor in the Raphael & Mtebe (2017) study, IT support appears to play a valuable role in determining self-efficacy towards educational technology integration. It was also a significant obstacle to technology integration as outlined in the Pelgrum (2001) study of 26 countries, which cited a lack of technical staff, and insufficient technical support as prominent factors.

The perception of support in a work environment is very significant: "high levels of support are needed for preservice and in-service teachers to develop confidence and self-efficacy in integrating technology" (Byker, Polly in Byker, Putman, Polly, & Handler, 2018, p. 122). Ottenbreit-Leftwich (in Lemon & Garvis, 2015, p. 5) noted that "even with a vision and technology resources, technology integration is not achievable unless teachers receive support for technology use in their classrooms". Gomes (as cited in Bingimlas, 2009, p. 241) also viewed support as essential: "in science teaching, several studies indicated that lack of technical support is a main barrier to using technologies.

Jones (as cited in Buabeng-Andoh, 2012, p. 144) explained that a fear of equipment failure coupled with a perceived lack of support would discourage teachers from using educational technologies in the classroom. Tong & Trinidad (in Buabeng-Andoh, 2012, p. 144) asserted that "if there is no technical support for teachers, they become frustrated, resulting in their unwillingness to use ICT". Lewis (as cited in Bingimlas, 2009, p. 241) also explicated that "without both good technical support in the classroom and whole-school resources, teachers cannot be expected to overcome the barriers preventing them from using ICT".

2.6 Summary

While digital competence and self-efficacy are important facets of technology integration, other elements such as outcome expectations and IT support also share a relationship with the integration of technology in an educational setting. An understanding of the convergence of these factors, and an adaptive response therein, would serve educational institutions in their endeavors to create conditions favorable to educational technology integration.

2.7 Conceptual Framework

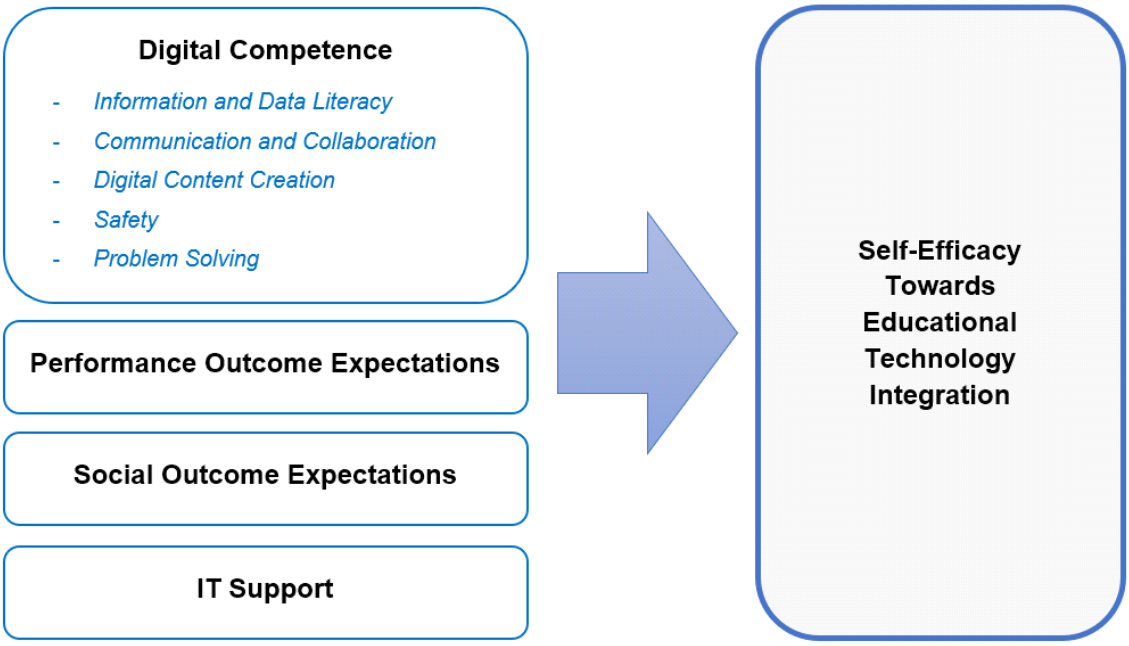

Figure-1: Conceptual Framework

3. RESEARCH METHODOLOGY

3.1 Research Design

Thai native teachers at primary and secondary level schools within the greater Pakchong region of Nakhon Ratchasima province were the focus of this study. It was the researcher's view that due to the insufficient numbers and temporary nature of residency in Thailand, non-native teachers were excluded from the population.

3.2 Population

The population for this research was in-service Thai teachers from eighty-seven government and private schools within the greater Pakchong region of Nakhon Ratchasima province. The total number of accessible teachers was approximately one thousand, one hundred and fifty-two individuals.

3.3 Sample

The sample for this case study was Thai teachers from Pakchong, Nakhon Ratchasima province. This sample included all in-service teachers, regardless of age, gender, length of service, or subject area within the defined institutions. The sample size utilized in the final survey was 233 teachers in total.

3.4 Sampling Technique

To calculate the sample size, a power analysis method was employed using G*Power software (Erdfelder, E., Faul, F., & Buchner, A., 1996). In this study, a priori analysis that computed required sample size was calculated via the following value, Linear Multiple Regression: Fixed

model, R2 Deviation from zero, estimate effect size of .15 with .05 error and 8 predictors. The results showed that the study required a minimum of 160 as a sample size. In the final data collection, the researcher received a total of 233, which exceeded 160, the minimum obligated sample number.

3.5 Research Instrument Development

This research was a quantitative study based on an online 5-point Likert scale survey consisting of thirty-seven self-reported questions, with 4 optional open questions and offered in Thai language only. The optional questions element covered teachers' opinions on the adequacy of pre-service training, incentives for continuous professional development, obstacles to technology integration, and the importance of teacher digital competence.

The questionnaire was created from items validated in previous studies and modified for this research. It was a synthesis of pre-existing constructs adapted to suit the context of a study of in-service teachers. The survey instrument was guided by the following research studies: 'Digital Competence, Teacher Self-efficacy, and Training Needs' (Mannila, Nordén, & Pears, 2018), 'Pre-Service Teachers' Self-Efficacy Beliefs Towards Educational Technologies Integration in Tanzania' (Raphael & Mtebe, 2017), and 'Validation of the Intrapersonal Technology Integration Scale: Assessing the Influence of Intrapersonal Factors that Influence Technology Integration' (Niederhauser & Perkmen, 2008).

The study conducted by Raphael & Mtebe (2017) was the foundation for this research and was adapted to include digital competence as a construct. As digital competence is defined as a convergence of technology-related skillsets it thus offers areas of expertise that can inform professional development and in-service training strategies going forward.

3.6 Reliability and Validity

Reliability of the instrument was tested using Cronbach's alpha coefficient test to measure internal consistency at both the pilot (**Table 1**) and official (**Table 2**) phase, with all variables displaying a value of 0.70 or higher. The results of the reliability testing determined that an acceptable level of reliability had been met by all variables.

As the survey instrument was based on previously validated instruments, validity was deemed acceptable for purpose in this research context. In the Raphael & Mtebe (2017) study, survey sources indicated satisfaction of discriminant validity and nomological validity. The Niederhauser & Perkman (2008) study cited content validity as established by three social cognitive career theory experts. Finally, the digital competence construct was based upon the DigComp 2.0 (Vuorikari, Punie, Carretero, & Van Den Brande, 2016) digital competence framework for citizens, and informed by the study conducted by Mannila, Nordén, & Pears (2018).

3.7 Collection of Data

Using contact details as provided by the local educational office, all 87 schools were contacted for consideration in this study. Upon receiving permission, the survey was distributed among the sample group using Line application. Data were then collected using Google Forms, with the interpretation and analysis conducted using predictive analytics software.

Table 1: Cronbach's Alpha Value of Pilot Survey Variables

Variables	Number of Items	Cronbach's Alpha Value
Information and Data Literacy	3	0.70
Communication and Collaboration	6	0.85
Digital Content Creation	4	0.70
Safety	4	0.75
Problem Solving	4	0.78
Performance Outcome Expectations	3	0.90
Social Outcome Expectations	3	0.87
IT Support	4	0.77
Self-Efficacy Towards Educational Technology Integration	6	0.91

Table 2: Cronbach's Alpha Value of Actual Survey Variables

Variables	Number of Items	Cronbach's Alpha Value
Information and Data Literacy	3	0.83
Communication and Collaboration	6	0.94
Digital Content Creation	4	0.86
Safety	4	0.86
Problem Solving	4	0.94
Performance Outcome Expectations	3	0.94
Social Outcome Expectations	3	0.91
IT Support	4	0.95
Self-Efficacy Towards Educational Technology Integration	6	0.96

4 DATA ANALYSIS AND RESULTS

4.1 Demographic Data

Survey respondents were requested to complete a preliminary demographic details section on commencing the distributed survey. An overview of the demographic profile is presented in **Table 3**.

Based on data collected, female respondents accounted for approximately 76% of the sample population, with most respondents in the 31-50 years age-group (43%). 77% of respondents had acquired a bachelor's degree as their highest educational achievement.

47% of respondents had 10 years of teaching experience or under, 80% of respondents worked at a government school, a 78% majority taught at primary level, with 61% of teachers declaring a substantial level of personal interest in technology.

Math teachers were the most represented at 30%, followed by social studies at 18%. 45% of respondents stated that they 'frequently' pursued self-directed learning.

Finally, many respondents owned technological devices, with laptops and smartphones being the most prevalent.

Table 3: Demographic Profile of Respondents

	Male	**Female**	
Gender	24.5%	75.5%	
	≤30	**31-50**	**>50**
Age Range	23.6%	42.9%	33.5%
	Bachelor	**Postgraduate**	**Doctorate**
Educational Background	77.3%	21.9%	0.9%
	≤10 Years	**11-20 Years**	**>20 Years**
Teaching Experience	46.8%	17.6%	35.6%
	Government School	**Private School**	**International School**
Employment	80.3%	16.3%	3.4%
	Primary	**Secondary**	
Teaching Level	77.7%	22.3%	
	Substantial	**Moderate**	**Negligible**
Interest in Technology	61.4%	33.5%	5.2%

4.2 Regression Analysis Results

Multiple regression analysis was used to investigate whether digital competence, performance outcome expectations, social outcome expectations, and IT support could significantly predict teachers' self-efficacy towards educational technology integration. The regression analysis indicated that the model explained 75% of the variance, and that it was a significant predictor of teachers' self-efficacy towards educational technology integration.

The sample multiple correlation was .87, indicating that approximately 75% of the variance in teachers' self-efficacy towards educational technology integration could be accounted for by the linear combination of these variables. The linear combination of variables was statistically significant related to the overall satisfaction F (8, 224), = 83.06, p = .00. The F-Test (ANOVA) was statistically significant ($p < .05$), thus the null hypothesis was rejected.

Four significant predictors out of eight independent variables were positively related to the criterion in the regression analysis (**Table 4**). The individually significant predictor variables were social outcome expectations, problem solving (sub-variable), performance outcome expectations, and IT support. Social outcome expectations had the highest regression coefficient at .77, followed by problem solving .75, performance outcome expectations .69, and IT support .59. The strongest predictor was social outcome expectations which accounted for .77 or 59% of the variance in teachers' self-efficacy towards educational technology integration. The lowest predictor was IT support which accounted for .59 or 35% of the variance in teachers' self-efficacy towards educational technology integration.

The formula for predicting teachers' self-efficacy towards educational technology integration from digital competence, performance outcome expectations, social outcome expectations, and IT support is as follows:

$$\hat{Y} = .09 + .29X_1 + .24X_2 + .13X_3 + .02X_4 + .26X_5 + .01X_6 + (-.05)X_7 + .08X_8$$

Table 4: Regression Analysis Summary

	Mean	**SD**	**B**	**R**
Social Outcome Expectations	3.79	0.80	0.29	.77***
Problem Solving	3.49	0.84	0.24	.75***
Communication and Collaboration	3.69	0.79	0.13	.70
Safety	3.63	0.80	0.02	.70
Performance Outcome Expectations	4.07	0.77	0.26	.69***
Digital Content Creation	3.41	0.78	0.01	.67
Information and Data Literacy	3.81	0.72	-0.05	.59
IT Support	3.70	0.83	0.08	.59***

Note: $R^2 = .75$ ($N = 233$, $p < .05$)
*** $p < .01$

4.3 Summary of Findings

Multiple regression analysis was used to determine which variable or variables were the most significant and best predictor of teachers' self-efficacy towards educational technology integration. The individually significant predictor variables were social outcome expectations, problem solving, performance outcome expectations, and IT support. Based on the regression analysis outcome this model can be used to predict teachers' self-efficacy towards educational technology integration.

Approximately 75% of the variance in the dependent variable was associated with the independent variables. The F-test (ANOVA) was statistically significant, and the null hypothesis was rejected. Problem solving was the most individually significant sub-variable from the digital competence construct, with social outcome expectations the leading predictor of all four significant predictors.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Discussion of the Research Findings

The research outcomes showed that teachers' perceptions of digital competence, performance outcome expectations, social outcome expectations, and IT support do influence their self-efficacy towards educational technology integration. The individually significant predictors of teachers' self-efficacy towards educational technology integration were social outcome expectations, problem solving, performance outcome expectations, and IT support.

Parallels with studies conducted almost two decades ago were evident, reinforcing the gravity of the issue. As noted in the literature review, a 1998-99 survey of 26 countries (including Thailand) highlighted insufficient ICT knowledge and skills, and a lack of technological upskilling opportunities as the most common obstacles to ICT-related goals in schools. Insufficient IT support was also cited as a major obstruction (Pelgrum, 2001).

Findings also mirrored those of Hatlevik & Hatlevik's (2018) study, where general ICT confidence had a positive association with ICT self-efficacy for instructional purposes, echoing the viewpoint that a positive perception of one's ICT skills is a necessary determinant of self-efficacy in using ICT for instructional purposes.

Resilience to technological obstacles is also a beneficial outcome of ICT competence and efficacy, which in turn could explain 'problem solving' as a significant predictor of teachers' self-efficacy towards educational technology integration. This also replicates the findings of Elstad & Christophersen (2017), who cited a strong association between teachers' perceptions of digital competency to resolve challenges relating to ICT and their instructional self-efficacy.

Social outcome expectations as the dominant significant predictor reinforces previous findings that demonstrated how teachers' use of IT in lessons can be as a result of the impressions they have received from colleagues (Pynoo, as cited in Baydas, & Goktas, 2016). As Thailand is a highly collectivist culture, the potential for sociocultural factors having influence on attitudes towards technology integration is quite significant. Taking this into consideration, policymakers could promote positive culture-specific approaches to technology integration.

An interesting characteristic linked the Raphael & Mtebe (2017) study with present research; social outcome expectations was the foremost significant predictor with IT support being the lowest of four significant predictors. The inverse occurred in the Raphael & Mtebe (2017) study. IT support was the principal predictor, with social influence having a negative significant effect. This may be explained by the sample variation, i.e. teachers in preservice training juxtaposed with teachers of substantial in-service experience. The primary age-range of the in-service teacher study was 31-50 years of age (43% of respondents), which points at a large percentage of teachers having considerable workplace experience and maturity.

Performance outcome expectations was also a significant predictor of teachers' self-efficacy towards educational technology integration, thus aligning with the viewpoints of Williams (2010). When teachers feel confident that their actions can achieve certain outcomes it serves as motivational stimuli to pursue said action. In Perkman & Surmelioglu's (2016, p. 93) study of 228 high school teachers in Turkey, technology integration self-efficacy and outcome expectations also displayed a moderate relationship, with performance outcome expectations of particular note. Believing one has the necessary skills to use educational technology usually means one expects said use to make a positive impact, and therefore have positive outcome expectations.

As indicated by Manila, Norden, & Pears (2018, p. 84),"training efforts should not only focus on helping teachers develop their digital knowledge and skills, attitudes and mindsets are likely to be equally important, and deserve more attention and educational investment". Making teachers aware of the potential outcomes afforded by the use of technologies could influence their motivation to pursue certain technological strategies.

IT support was the fourth significant predictor of self-efficacy towards educational technology integration. This corresponded with the literature where it was cited as an important predictor of actual ICT usage in an educational setting (Moses in Acker, Buuren, Kreijns, & Vermeulen, 2011), and a major barrier to technology integration when found to be insufficient (Schoepp, 2004, p. 3). IT support was also a significant predictor in Raphael & Mtebe's (2017) study.

The digital competence construct of the present research model was informed by the Mannila, Nordén, & Pears (2018) study and survey instrument, and also the Govender & Govender (2009) research outcomes, where teachers' ICT competency levels were found to be related to their self-efficacy beliefs regarding ICT integration. When considered as a complete model, all variables together (inclusive of the sub-variables of digital competence) were a significant predictor of teachers' self-efficacy towards educational technology integration. However, problem solving was the only independent significant sub-variable of the digital competence construct.

The problem-solving sub-variable refers to teachers' beliefs in their innovative ability to solve technical problems, the ability to identify technological needs and knowledge gaps, and their creative use of technology. As highlighted by Hatlevik & Hatlevik (2018, p. 80), teachers "need to be competent in a skill in order to incorporate it when instructing others". With creative problem solving a critical technological skill, its lower self-reported confidence rating and significant influence on self-efficacy towards educational technology integration make it a key research outcome.

It is important to ask how culture may shape creativity and innovative use of technology. Cachia & Ferrari (2010, p. 17) highlight culture, curriculum, teachers, and technology as enablers of creativity. Shao, Zhang, Zhou, Gu, & Yuan (2019, p. 1) stipulate that "individuals from different cultures, particularly those from individualist and collectivist cultures, show differences in preferred creative processes and creative processing modes". Henriksen, Mishra, & Fisser (2016, p. 27) assert that "creativity is deeply connected to issues of technology integration, so these issues of creativity and technology can be considered in tandem". Henriksen et al (2018, p. 409) also reported that "creativity is widely considered to be a key construct for twenty-first century education".

Creativity as a key element of problem-solving is quite significant to this research as the focus was a region containing many small and rural schools. Creativity is essential for low-resource learning environments for many reasons. It informs how teachers respond to unpredictability, how they overcome limitations, and how they capitalize on minimal resources. Creativity and problem solving are relevant to both teacher and student alike, "when learners understand that teachers value creativity, they are more prone to being creative" (Fasko, 2001, as cited in Cachia & Ferrari, 2010, p. 17). Furthermore, the introduction of coding is now being considered for the Thai school curriculum, with creativity and problem-solving a fundamental prerequisite.

Overall, teachers' general digital competence levels appeared normative, but a disparity was evident in the type of skill and how teachers rated themselves. For example, skills afforded lowest confidence were programming, the production of digital content, adapting to new

technology, solving digital problems, and assessing competence gaps. Skills that scored highest were information searching, awareness of environmental impact, netiquette, and sharing of content. While said skills are important, it's interesting to note that the lower scoring skills again related to innovation and problem solving, abilities that require a measure of distinction on the part of the individual, while the higher rated skills were of the more generic variant.

In lieu of these findings we may ask what is influencing teachers' confidence regarding innovative approaches to technology integration? Could it be an aspect of workplace culture, or a trait of collectivism? In collectivist societies, individuals identify more with being a group member than an autonomous individual, which can influence risk-taking, goals, and a desire for uniqueness (Reis, as cited in Bangkok Post, 2012). Asian cultures tend to be more collectivistic in nature, therefore it is not unreasonable to assume that it may have some significance. It is the researcher's view that sociocultural influences and their effects on teachers' predispositions towards the integration of educational technology in teaching requires further consideration.

5.2 Optional Questions

Regarding the discussion on whether teachers felt that they had received adequate preservice training in using educational technology tools, twenty six percent stated no, while a further twenty percent declined to comment. When queried about suggesting incentives that may encourage teachers to pursue continuous professional development in terms of technology integration, a selection of responses repeatedly arose. Namely organizational support, recognition of effort, having trained personnel on site, the provision of training opportunities, and more technological resources.

Obstacles to technology integration that were noted by numerous respondents were technological knowledge, conservative attitudes, educational policy, workload, resources, and training opportunities. When asked to outline why teachers considered digital competence to be important for teachers today, they suggested the efficiency afforded, the necessity for 21st century skills, and the obligation to keep pace with student capabilities.

Interestingly, teachers seemed well-versed in the benefits of technology integration, they displayed positivity towards it, a will for self-improvement, and enthusiasm for guidance and support to pursue technology integration as a learning environment objective.

5.3 Implications for Practice

It is hoped that the findings in this study can provide some guidance on how to assess and reflect on current technological needs and inform approaches to technology integration in the classroom.

It is imperative that educators and educational institutions create an environment that reflects and supports the external reality of modern society, and affords students a well-rounded and inclusive learning experience, informed by creativity and divergent thinking. Continuous self-reflection and development are required to this end. Buabeng-Andoh (2012, p. 142) stipulated that teachers' professional development is a key factor to successful integration of ICT into classroom teaching and asserted that development and continuing support are examples of strong determinants of successful technology integration. Institutions have a pressing obligation to offer and promote diverse opportunities for the professional development of their staff.

The marriage of technology and creativity allows teachers to pursue novel and interesting pedagogical practices, while also providing students with opportunities for creative output

which would not have been previously possible. This has implications for teacher education and professional development, the assessment and evaluation of student skillsets, and educational policy (Henriksen, Mishra, & Fisser, 2016, pp. 31-32).

School leadership also plays an instrumental role in technology integration. Stakeholders can offer guidance by creating a goal-oriented work environment with a view to technology integration. As mentioned earlier, culture itself may play a part in influencing the perceptions and dispositions of teachers. As observed by Henriksen et al (2018, p. 420) "another challenge may be to overcome pre-existing traditions and cultures, which sometimes involve practices that are antithetical to creativity, yet are endemic in many schools".

5.4 Recommendations for Future Research

A reenactment of this study at provincial if not national level would offer a richer dataset to assess needs on a larger scale. The influence of individualism and collectivism could also be considered in future research, how they impact on risk-taking, conformity, autonomous approach, and organizational culture. An exploration of how to effectively promote creativity and individuality in collectivist cultures, and as an explicit group goal may prove constructive too.

This study may also be broadened to include the recent addition to the EU digital competence assessment tools: the educators competence survey. The DigCompEdu framework is wider in scope than DigComp 2.0. This new framework focuses on additional factors such as organizational communication, assessment strategies, differentiation, personalization, and self-regulated learning (Caena & Redecker, 2019, pp. 356-363).

Finally, an assessment of educational leadership attitudes may embellish the original study, namely their perceptions, intentions, and dispositions regarding the integration of educational technology, school technology policy, and approach to ongoing skills development.

5.5 Conclusion

This study has established that digital competence, performance outcome expectations, social outcome expectations, and IT support do influence teachers' self-efficacy towards educational technology integration. It also emphasizes intrinsic determinants of technology integration as important considerations for low-resource schools. Where extrinsic issues are often budget and hardware-related, intrinsic impediments relate to people and perception, and are therefore universal.

The research outcomes also call attention to specific areas of relevance, such as the problem solving and divergent thinking aspect of digital competence, and the strong influence of social outcome expectations on self-efficacy towards technology integration. Both suggest a possibility that culture itself may impact on the approach to educational technology integration, plus the necessity for promoting risk-taking in a potentially risk-adverse culture. An analysis of this facet may help to shape institutional policy by aligning the advocacy of technology integration with cultural attitudes and behaviors.

Creating a technology-supported learning environment in the digital age is a complex task involving numerous actors such as students, parents, school leadership, and governments. Schools need to create a 'social contract' whereby teachers agree to and are encouraged to collaborate, share information and skills, and foster a digitally inclusive work environment of continuous self-improvement. Technology integration needs to become a recognized institutional norm, appropriately regulated, openly discussed, and positively acknowledged as an educational workplace objective.

Educational institutions and stakeholders need to be more proactive in endorsing technology integration in learning environments. Promoting effective technology integration involves nurturing a culture of support, engaging in dialogue, offering transparency, recognition, and reward. It also requires patience, and an openness to change and creative exploration. These are some of the key ingredients for encouraging educational technology integration in today's learning environments. To that end, teachers need to be dynamic, creative role models, with supportive institutions their enablers.

REFERENCES

Acker, F. V., Buuren, H. V., Kreijns, K., & Vermeulen, M. (2011). Why teachers use digital learning materials: The role of self-efficacy, subjective norm and attitude. *Education and Information Technologies, 18*(3), 495-514. doi:10.1007/s10639-011-9181-9

Akarawang, C., Kidrakran, P., & Nuangchalerm, P. (2015). Enhancing ICT competency for teachers in the Thailand basic education system. *International Education Studies, 8*(6), 1–8. doi:10.5539/ies.v8n6p1

Bangkok Post. (2012, March 29). Encouraging creativity in collectivist cultures. Retrieved February 11, 2019, from https://www.bangkokpost.com/business/286475/encouraging-creativity-in-collectivist-cultures

Baydas, O., & Goktas, Y. (2016). A model for preservice teachers' intentions to use ICT in future lessons. *Interactive Learning Environments, 25*(7), 930-945. doi:10.1080/10494820.2016.1232277

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science and Technology Education, 5*(3), 235-245. doi:10.12973/ejmste/75275

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development Using Information and Communication Technology, 8*(1), 136-155. Retrieved June 22, 2019, from https://files.eric.ed.gov/fulltext/EJ1084227.pdf

Byker, E. J., Putman, S. M., Polly, D., & Handler, L. (2018). Examining elementary education teachers and preservice teachers' self-efficacy related to technological pedagogical and content knowledge (TPACK) (C. B. Hodges, Ed.). *Self-Efficacy in Instructional Technology Contexts*, 119-140. doi:10.1007/978-3-319-99858-9_8

Cachia, R., & Ferrari, A. (2010). *Creativity in schools: A survey of teachers in Europe*. Publications Office of the European Union. Retrieved from http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=3702

Caena, F., & Redecker, C. (2019). Aligning teacher competence frameworks to 21st century challenges: The case for the European digital competence framework for educators (Digcompedu). *European Journal of Education*, *54*(3), 356–369. doi:10.1111/ejed.12345

Elstad, E., & Christophersen, K. (2017). Perceptions of digital competency among student teachers: Contributing to the development of student teachers' instructional self-efficacy in technology-rich classrooms. *Education Sciences, 7*(1), 27. doi:10.3390/educsci7010027

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, & Computers*, *28*(1), 1–11. doi: 10.3758/bf03203630

Govender, D., & Govender, I. (2009). The relationship between information and communications technology (ICT) integration and teachers' self-efficacy beliefs about ICT. *Education as Change, 13*(1), 153-165. doi:10.1080/16823200902943346

Hatlevik, I. K., & Hatlevik, O. E. (2018). Examining the relationship between teachers' ICT self-efficacy for educational purposes, collegial collaboration, lack of facilitation and the use of ICT in teaching practice. *Frontiers in Psychology, 9,* 1-8. doi:10.3389/fpsyg.2018.00935

Henriksen, D., Henderson, M., Creely, E., Ceretkova, S., Černochová, M., Sendova, E., Tienken, C. H. (2018). Creativity and technology in education: An international perspective. *Technology, Knowledge and Learning*, *23,* 409–424. doi:10.1007/s10758-018-9380-1

Henriksen, D., Mishra, P., & Fisser, P. (2016). Infusing creativity and technology in 21st century education: A systemic view for change. *Educational Technology & Society*, 19, 27-37.

Hernández-Ramos, J. P., Martínez-Abad, F., Peñalvo, F. J., García, M. E., & Rodríguez-Conde, M. J. (2014). Teachers' attitude regarding the use of ICT. A factor reliability and validity study. *Computers in Human Behavior, 31,* 509-516. doi:10.1016/j.chb.2013.04.039

Hew, K. F., & Brush, T. (2006). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*(3), 223-252. doi:10.1007/s11423-006-9022-5

Johannesen, M., Øgrim, L., & Giæver, T. H. (2014). Notion in motion: Teachers' digital competence. *Nordic Journal of Digital Literacy, 9*(4), 301-312. Retrieved January 12, 2019, from https://www.idunn.no/dk/2014/04/notion_in_motion_teachersdigital_competence_.

Kent, A. M., & Giles, R. M. (2017). Preservice teachers' technology self-efficacy. *SRATE Journal, 26*(1), 9-20. Retrieved June 15, 2019, from https://eric.ed.gov/?id=EJ1134392

Lakkala, M., Ilomäki, L., & Kantosalo, A. (2011). Which areas of digital competences are important for a teacher*?* Manuscript, European Schoolnet (EUN), University of Helsinki, Brussels. Retrieved June 30, 2019, from https://researchportal.helsinki.fi/en/publications/which-areas-of-digital-competences-are-important-for-a-teacher

Lemon, N., & Garvis, S. (2015). Pre-service teacher self-efficacy in digital technology. *Teachers and Teaching, 22*(3), 387-408. doi:10.1080/13540602.2015.1058594

Lippke, S. (2017) Outcome expectation. In: Zeigler-Hill V., Shackelford T. (eds) Encyclopedia of Personality and Individual Differences. Springer, Cham

Mannila, L., Nordén, L., & Pears, A. (2018). Digital competence, teacher self-efficacy and training needs. *Proceedings of the 2018 ACM Conference on International Computing Education Research - ICER 18,* 78-85. doi:10.1145/3230977.3230993

Niederhauser, D. S., & Perkmen, S. (2008). Validation of the intrapersonal technology integration scale: Assessing the influence of intrapersonal factors that influence technology integration. *Computers in the Schools, 25*(1-2), 98-111. doi:10.1080/07380560802157956

Niederhauser, D. S., & Perkmen, S. (2010). Beyond self-efficacy: Measuring pre-service teachers' instructional technology outcome expectations. *Computers in Human Behavior, 26*(3), 436–442. doi:10.1016/j.chb.2009.12.002

Pelgrum, W. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education, 37*(2), 163-178. doi:10.1016/s0360-1315(01)00045-8

Perkmen, S., & Surmelioglu, Y. (2016). Measurement of teachers' self-efficacy and outcome expectations for technology integration in education. *TOJET: The Turkish Online Journal of Educational Technology Special Issue for INTE 2016*, 88–94.

Raphael, C., & Mtebe, J. S. (2017). Pre-service teachers' self-efficacy beliefs towards educational technologies integration in Tanzania. *Journal of Learning for Development, 4*(2), 196-210. Retrieved April 12, 2019, from https://jl4d.org/index.php/ejl4d/article/view/190/0.

Schoepp, K. (2004). Barriers to technology integration in a technology-rich environment. *Learning and Teaching in Higher Education: Gulf Perspectives, 2,* 1-23. Retrieved May 25, 2019, from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.87.5771

Shao, Y., Zhang, C., Zhou, J., Gu, T., & Yuan, Y. (2019). How does culture shape creativity? A mini-review. *Frontiers in Psychology*, *10*, 1–8. doi:10.3389/fpsyg.2019.01219

Vuorikari, R., Punie, Y., Carretero, S. G., & Van Den Brande, G. (2016). *DigComp 2.0: The digital competence framework for citizens. Update phase 1: The conceptual reference model*. Luxembourg Publication Office of the European Union. doi:10.2791/1151

Williams, T., & Williams, K. (2010). Self-efficacy and performance in mathematics: Reciprocal determinism in 33 nations. *Journal of Educational Psychology*, *102*(2), 453-466. doi:10.1037/a0017271