

# **A Thai Junior High School Students' 21<sup>st</sup> Century Information Literacy, Media Literacy, and ICT Literacy Skills Factor Analysis**

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**Abstract**—As Thailand moves through the 21st Century, the education system and resultant labor force must be prepared for rapid changes in Thailand's society, culture, politics, economy, and technologies. Previously, the 21st century framework has identified crucial elements for future success as information literacy, media literacy, and information and communication technology (ICT) literacy skills. Given this priority, by use of multistage clustering sampling, 380 Thai junior high school students were selected, from which a five level, 73-item Likert type agreement scale questionnaire was used to collect data from October 2017 to December 2017. The analysis of the student's skills in information literacy, media literacy, and ICT literacy was conducted with the use of SPSS Version 24 software mean ( $\bar{x}$ ), standard deviation (S.D.), the Kaiser Meyer Olkin (KMO) test, and Bartlett's test of sphericity for analysis. Furthermore, a second-order confirmatory factor analysis was undertaken in which AMOS Version 24 software was used. Based on the second order CFA, it was found that the Information, Media and Technology Skills (IMTS) model was composed of three components that corresponded to the empirical data, with the most important element being ICT literacy (.998), followed by media literacy (.992), and finally, information literacy (.947).

**Keywords**—information, media and technology skills (IMTS), second order CFA, Thailand

## **1 Introduction**

Directives from the European Union have stated that there needs to be relevant and high-quality knowledge, skills, and competences developed throughout lifelong learning, which focuses on learning outcomes for employability, innovation, active citizenship, and well-being [1]. Also, an OECD/UNESCO review of Thai education policy concluded that information and communication technologies (ICT) can support innovative teaching practices, and the creation of learning environments intended to develop students' competencies for success in the 21st century [2].

These reports are also consistent with Chaiyasut, Samuttai, Phuwiphadawa, and Inthanet, which indicated that technology literacy for learning and presentation was one

of the 13 life-long learning indicators [3]. To develop a country within this global context, it must be driven by innovation and creativity, along with the skills necessary for workers within a 21st Century environment [4-6]. Transforming however to the challenges of the 21st century dynamics is therefore based on high quality education, which meets the goals of Thailand's 12th National Economic and Social Development Plan (2017-2021), while focusing on the development of ICT skills [7-8].

The formalization of these ideas for Thailand is now referred to as 'Thailand 4.0', which has its roots in Industry 4.0 and the Internet of Things. Thailand 4.0 is also an economic model based on creativity, innovation, new technology, and high-level services [7].

### **1.1 Information, media and technology skills**

Today we live in a technology and media-suffused environment with: 1) access to an abundance of information, 2) rapid changes in technology tools, and 3) the ability to collaborate and make individual contributions on an unprecedented scale. According to the 21st Century Skills Framework, students must also be able to develop skills in information and media literacy and computing and ICT literacy [4-5] [9]. To be effective in the 21st century, citizens and workers must be able to create, evaluate, and effectively utilize information literacy, media literacy, and technology, or ICT literacy [10].

To develop a country within a global context, it must be driven by innovation and creativity, along with the skills necessary for workers within a 21st century environment [4]. 21st century skills are the special talents that children need to develop in order to be ready for the 21st century work and life challenges. To succeed in studying, working and living, one needs to have lifelong learning skills. Additionally, the youth today will be faced with rapid, severe, and unexpected changes [11]. To achieve these goals, the Partnership for 21st Century Skills provided a conceptual framework of the skills necessary to meet these challenges [10]. They included: (1) learning and innovation skills, (2) information and technology skills (ICT) and, (3) life and career skills.

Therefore, information literacy, media literacy, and information communications technology (ICT) literacy skills play a crucial role in today's education as well. As such, the Thai government has also developed an Information and Communication Technology Policy Framework (2011-2020) or ICT 2020, in order to serve as the framework for developing the nation's ICT [12]. The framework targets delivering ICT infrastructure as a basic public utility that all citizens can access universally, with world-class quality and security standards by the year 2020.

### **1.2 Statement of the problem**

In the second half of 2017 Thailand rose to the number one position for use of the internet, with internet and social media use among Thai youth exploding, especially in the age group between 13 and 24 years old. The question arises however, what elements (ICTL, IL, or ML) within a 21<sup>st</sup> century framework are the most important in

this critical age group of 7<sup>th</sup>, 8<sup>th</sup>, and 9<sup>th</sup> grade junior high school students? It is this group of learners that Thailand's leaders hope will shoulder much of the responsibility of tasks expected by the new digitally enabled, knowledge worker being marketed under the flag of 'Thailand 4.0'. This study therefore analyzed a sample of 380 junior high school students from a major industrial estate province in Thailand's eastern seaboard.

## 2 Literature Review

For the study, the researchers adopted the recommendations as outlined in the 21st Century Skills Framework [4-5] [9]. This included ICT literacy (ICTL), information literacy (IL), and media literacy (ML).

### 2.1 Document title and meta-data

Information and communications technology literacy is the ability to use technology to develop 21st century content knowledge and skills, in the context of learning core subjects. Students must be able to use technology to learn content and skills — so that they know how to learn, think critically, solve problems, use information, communicate, innovate and collaborate.

Support for the importance of ICT in Thailand also came as recently as February 2018 when the London based research group '*We Are Social*' reported that from a survey of 39 countries, Thailand ranked first in the second and third quarters of 2017 for Internet use [13]. In the report, Thailand came in first place for time spent online, with an average of 9 hours and 38 minutes per day. This was followed by the Philippines (9 hours and 29 minutes), Brazil (9 hours and 14 minutes), and Indonesia (8 hours and 51 minutes). Additionally, for the third year in a row, Filipinos spent the greatest amount of time on social media (e.g. Facebook), with the average user in the country spending almost 4 hours on social every day [13].

As we see above, ICT literacy skills have become an integral component of an individual's everyday life. ICT literacy is interpreted to mean that if a person has the ability to use a computer, communication tools such as smartphones, and social network appropriately, they then can define, access, manage, evaluate, integrate, create and communicate effectively and responsibly [14]. Achieving ICT literacy skills is also crucial for research and evaluating information, which further promotes effective learning and working [15].

ICT mastery also has a significant impact on a nation's economic growth. According to an April 2017 McKinsey & Company report discussing digital transformation and China's manufacturing productivity, the report indicated that an annual growth of 6.5% over the next 15 years is possible if executed correctly [16]. Tan has also indicated that a 20% investment in ICT contributes 1% to gross domestic production (GDP), a 2.1% increase in competitiveness, a 2.2% increase in innovation, and a 2.3% in productivity [17]. The effective use of ICT can also improve life quality, reduce educational gaps, and raise efficiency in industrial.

However, shortages of industry-ready, ICT skilled workers present one of the biggest challenges for the five core member countries of the Association of Southeast Asian Nations, ASEAN-5, as they strive to realize their economic visions [15] [19]. Also, according to a 50-nation digital economy study from Huawei Technologies, Thailand only has one IT worker per capita, as compared to the study average of 3.18 workers [17]. It seems both Thai academic and ICT professional human resource development needs serious improvement in the upcoming years. Another resource to determine computer and information literacy (CIL) is the International Computer and Information Literacy Study (ICILS) [20]. CIL is defined by the study as an individual's ability to use computers to investigate, create and communicate in order to participate effectively at home, at school, in the workplace and in the community.

What is extremely interesting from the data gathered from the ICILS study on 60,000 Grade 8 students in more than 3,300 schools from 21 education systems, is that the report challenges the notion of young people as 'digital natives', with a self-developed capacity to use digital technology [21]. The large variations in CIL proficiency within and across the ICILS countries suggest it is naive to expect young people to develop CIL in the absence of coherent learning programs. Findings also indicate that system-and school-level planning needs to focus on increasing teacher expertise in using ICT for pedagogical purposes if such programs are to have the desired effect.

The ICILS conclusion is supported by statistics from Thailand as well. One example is even though Thai ICT expenditure accounted for 7% of Thai GDP in 2015, of the projected annual requirement of 6,000 - 7,000 Thai ICT professionals, only 10% of the ICT graduates are considered employable according to interviews conducted with Association of Thai ICT Industry members [19]. This is a major reason that the Thai government has singled out human capital development as a key focus of the 12th NESDP 2017-2022 plan, and implemented other plans such as the STEM Master Plan 2015 [22].

Therefore, multiple studies have determined that there is a serious and significant problem with ICT education and skill development in Thailand, whose goals are always falling short. The country's vision for the future has additionally placed ICT at the core of 10 identified key industries and the nation's economic growth [23]. The researchers therefore determined the requirement for an analysis of current information literacy, media literacy, and ICT literacy skills within Thai junior high schools.

## **2.2 Information literacy**

According to UNESCO, "Information literacy means the set of skills, attitudes and knowledge necessary to know when information is needed to help solve a problem or make a decision, how to articulate that information need in searchable terms and language, then search efficiently for the information, retrieve it, interpret and understand it, organize it, evaluate its credibility and authenticity, assess its relevance, communicate it to others if necessary, then utilize it to accomplish bottom-line pur-

poses; Information Literacy is closely allied to learning to learn, and to critical thinking, ..." [24].

### 2.3 Media Literacy

Media literacy is the ability to access, analyse, evaluate and create messages in a variety of forms [25-26]. These four components - access, analysis, evaluation and content creation - together constitute a skills-based approach to media literacy [27].

### 2.4 The Hierarchical Linear Model

From a synthesis of the research and theory, the following hierarchical linear model conceptual framework was established (Fig. 1). The model shows the causal relationship diagram between the independent student and school variables as well as variables based on a student's proper internet usage [9]-[11].

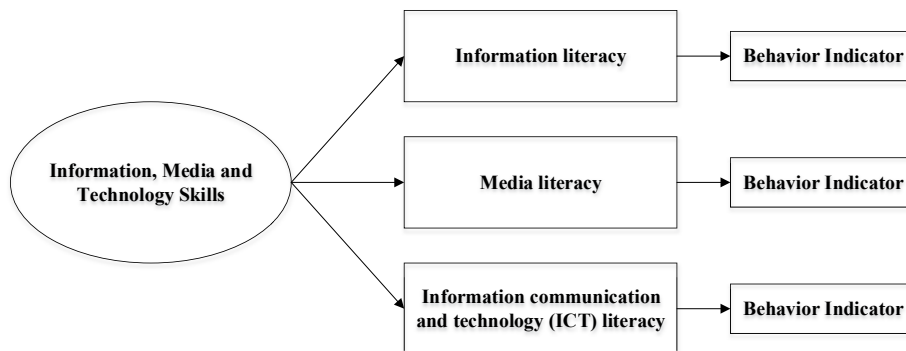


Fig. 1. Conceptual framework for the 2<sup>nd</sup> order CFA for the IMTS model of Thai junior high school students

## 3 Methods

### 3.1 Population and Sample

The study took place at Streesmutprakan School, an older Thai school in Samut Prakarn Province just east of Bangkok. The school started its existence in 1883 as a girl's school, however in 1992, the school became co-ed. In 2017, the school's student population was 2,814. However, as the study was focused on IT related education, only grades 7, 8 and 9 were selected due to the fact that these grades contain the Thai government mandated course 'Occupational Learning and Technology' from the Office of the Basic Education Commission (OBEC). From these three grades, the student population size was reduced to 1,350 students, of which 836 were girls and 514 were boys. According to Mertler, in education research if population size is

around 1,500, a sample size of 300 is adequate [30]. Also, beyond a certain point (n = 5,000), the population size becomes irrelevant and a sample size of 400 will be adequate. Increasing the size of the sample beyond this point is not critical, but doing so will increase the confidence with which the researcher can generalize results. Next, the first phase of the sample selection process was conducted by multi-stage, cluster sampling. A lottery process was then used for class selection (Table 1). Development of the questionnaire was conducted online with use of Google forms. The questionnaire link was subsequently e-mailed to two teachers who were responsible for the questionnaire's distribution, completion, and audit by each of the study's students.

**Table 1.** Student population for grades 7-9

Grade	Male	Female	Total
7	176	282	458
8	173	278	451
9	165	276	441
<b>Totals</b>	514	836	1,350

### 3.2 Research tools

The tools used to collect data were the appropriate Internet usage behavior questionnaire and related information which used a 5-level, Likert type agreement rating scale (Table 1). The researchers created a comprehensive study from the independent and dependent variables, and modified it for the high school students' questionnaire on learning behavior through electronic and related information (Appendix 1).

**Table 2.** Questionnaire's latent and observed variables

Latent Variables	Observed variables	Abbrev.	Survey Items
Information Literacy (IL)	know access evaluate use	KNO ACCESS EVAL USE	17
Media Literacy (ML)	access analyze evaluate create participate	ACCM ANA EVAM CREM PAR	25
Information and Communications Technology Literacy (ICTL)	access manage integrate evaluate create communicate	ACCT MAN INI EVAT CRET COM	31

Verification of the questionnaire's content validity was confirmed using the Index of Consistency (IOC). To evaluate the internal consistency of constructs (ICR), Cronbach's  $\alpha$  was used to test the unidimensionality of the 5-level agreement scale

questionnaire items and measure to which extent all the variables are related to each other [28]. The scales used were ranked as follows: 1 = minimum, 2 = minimal, 3 = moderate, 4 = very high, 5 = highest. Various scholars have reported on different acceptable values of  $\alpha$ , ranging from 0.70 to 0.95 [29]. The reliability of the latent variables however were found to exceed all recommended minimums, and were calculated for information literacy at 0.96, for media literacy at 0.96, and for ICT literacy at 0.97.

### **3.3 Data analysis**

The analysis of the data entailed a 3-step process. It is outlined as follows:

1. The analysis of the student's skills in information literacy, media literacy, and ICT literacy was conducted with the use of SPSS Version 24. Descriptive statistics used mean ( $\bar{x}$ ) and standard deviation ( $\sigma$  or S.D.).

2. The Kaiser Meyer Olkin (KMO) test was also used as it is used in factor analysis to test how well the data is suited. For reference, Kaiser put the following values on the results as [31]:

0.00 to 0.49 = unacceptable.

0.50 to 0.59 = miserable/very bad.

0.60 to 0.69 = mediocre/not so good.

0.70 to 0.79 = middling/OK.

0.80 to 0.89 = meritorious/very good.

0.90 to 1.00 = marvellous/excellent.

3. Another SPSS test which is recommended and often used in conjunction with KMO is Bartlett's Test of Sphericity, which is a measure of sampling adequacy. KMO was also run against the sample group.

## **4 Results**

### **4.1 Student characteristics**

Table 3 presents the general information from the 380 student questionnaire compilation.

### **4.2 Model validation**

The researchers analyzed the distribution of IL, ML, and ICTL for 380 Thai 7<sup>th</sup>, 8<sup>th</sup>, and 9<sup>th</sup> graders enrolled in ICT classes. Descriptive statistics used included the mean, standard deviation (S.D.), and the correlation coefficient of the observed variables. Results from the analysis of the 15 observed variables are shown in Table 5 and Table 6. The results of the analysis concluded that the relationships between the total of 105 pairs was statistically significant at the 0.01 level. All pairs showed that the correlation coefficient between variables was positively correlated with the relationships taking place in the same direction.

**Table 3.** Student's general characteristics

<b>General Information</b>	<b>Junior High School Student(n=380)</b>	
<i>Sex</i>	<i>Number</i>	<i>Percent</i>
Male	190	50.00
Female	190	50.00
Total	380	100.00
<i>Grade</i>	<i>Number</i>	<i>Percent</i>
Grade 7	128	33.6
Grade 8	126	33.2
Grade 9	126	33.2
<b>Total</b>	<b>380</b>	<b>100.00</b>

Additionally, it was noted that the observed variables having the highest correlation coefficient were ACCT and COM (0.836). This was followed by COM and PAR at 0.808. EVAM and USE on the other hand, had the lowest correlation coefficient at 0.485. Furthermore, the researchers used Bartlett's Test of Sphericity to test the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is matrix in which all of the diagonal elements are 1 and all off diagonal elements are 0. You want to reject this null hypothesis. The Chi-Square values were 5692.381,  $df = 105$ ,  $p = 0.120$ .

The Kaiser-Meyer-Olkin measure of sampling adequacy is used in conjunction with the Bartlett's Test whose measures vary between 0 and 1, with values closer to 1 being better. A value of .6 is a suggested minimum.

Table 5 shows the results of the structural integrity check of the Thai junior high school students' Information, Media and Technology Skills (IMTS) goodness-of fit appraisal. After the completion of the second order CFA, the model was found to be consistent with the empirical data, as Chi-square = 61.423,  $df = 48$ , and  $p = 0.092$ .

Additionally, the mean value of  $\chi^2$  was not significantly different from zero. Furthermore, statistical analysis was done at 0.05 level and  $\chi^2/df$  was shown to = 1.249, which was less than the suggested cutoff of 2 [32]. Also, according to Byrne, the comparative fit index (CFI) should exceed 0.93, and the goodness of fit index (GFI) should exceed 0.90 [33]. For the study, the CFI was 0.998 and the GFI was 0.980. The AGFI (adjusted GFI) adjusts the GFI for degrees of freedom (df), resulting in lower values for models with more parameters. AGFI should also be at least .90, with values closer to 1 indicating a good fit [34]. As AGFI was 0.947, this also indicated a good model fit. Finally, the root mean square error of approximation (RMSEA) = 0.026 and root mean square residual (RMR) = 0.013. Confirmation of structural integrity of the model is shown in Table 4.



**Table 4.** 2nd order CFA of the IMTS model goodness-of-fit appraisal

Criteria Index	Criteria	Values	Results
$\chi^2$ - Sig. ( <i>p</i> value)	> 0.05	0.120	passed
$\chi^2$ /df	< 2.00	1.249	passed
RMSEA	< 0.05	0.026	passed
NFI	> 0.90	0.993	passed
CFI	> 0.93	0.998	passed
GFI	> 0.90	0.980	passed
AGFI	> 0.90	0.947	passed
RMR	< 0.05	0.013	passed

**Table 5.** KMO and Bartlett's Test of Sphericity test results (n = 380)

Observed Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
KNO (1)	1.00														
ACCI (2)	.717 **	1.00													
EVAL (3)	.629 **	.732 **	1.00												
USE (4)	.546 **	.614 **	.709 **	1.00											
ACCM (5)	.600 **	.686 **	.738 **	.696 **	1.00										
ANA (6)	.606 **	.651 **	.667 **	.617 **	.664 **	1.00									
EVAM (7)	.565 **	.606 **	.618 **	.485 **	.589 **	.667 **	1.00								
CREM (8)	.586 **	.601 **	.563 **	.508 **	.570 **	.644 **	.685 **	1.00							
PAR (9)	.613 **	.596 **	.624 **	.533 **	.561 **	.624 **	.669 **	.768 **	1.00						
ACCT (10)	.567 **	.557 **	.567 **	.512 **	.576 **	.625 **	.615 **	.662 **	.719 **	1.00					
MAN (11)	.594 **	.633 **	.656 **	.689 **	.638 **	.650 **	.650 **	.710 **	.751 **	.725 **	1.00				
INI (12)	.749 **	.698 **	.686 **	.664 **	.669 **	.632 **	.632 **	.680 **	.689 **	.672 **	.729 **	1.00			
EVAT (13)	.805 **	.869 **	.664 **	.559 **	.637 **	.591 **	.596 **	.588 **	.570 **	.517 **	.595 **	.695 **	1.00		
CRET (14)	.649 **	.823 **	.774 **	.593 **	.649 **	.663 **	.579 **	.545 **	.567 **	.533 **	.614 **	.652 **	.706 **	1.00	
COM (15)	.624 **	.646 **	.720 **	.598 **	.668 **	.660 **	.691 **	.731 **	.808 **	.836 **	.772 **	.725 **	.609 **	.625 **	1.00
Mean	3.56	3.63	3.64	3.61	3.70	3.53	3.59	3.61	3.61	3.64	3.67	3.56	3.62	3.61	3.65
S. D.	.720	.737	.750	.769	.809	.762	.722	.766	.723	.781	.760	.764	.768	.793	.722

KMO : Measure of Sampling Adequacy = .949, S.D. = Standard Deviation

Bartlett's Test of Sphericity: Chi-Square = 5692.381, df = 105, \*p < 0.05, \*\*p < 0.01

From Table 6, it was found that the factor loadings of the variables in each component were positive. The statistical significance level was 0.05 and the coefficient of determination ( $R^2$ ), which described the variance of the IMTS model values ranged from 0.719 to .863 and can be described separately in each of the various components.

Information literacy (IL) consisted of four variables, which were weighted from 0.719 to 0.844, and were statistically significant at the 0.05 level. The observed variable with the most significance was evaluation (EVAI), which had factor loadings of 0.844. The  $R^2$  was also high at = 0.722.

Media literacy (ML) consisted of five variables, which were weighted from 0.786 to 0.844 and statistically significant at 0.05 level. The observed variable with the most significance was CREM, which had a component weight of 0.844. The  $R^2$  was also high at = 0.712.

ICTL, with six significant factors, ranged from 0.757 to 0.863 and was statistically significant at the 0.05 level. The variable with the highest component weight was INT, which had a component weight of 0.863. The  $R^2$  was also high at = 0.744.

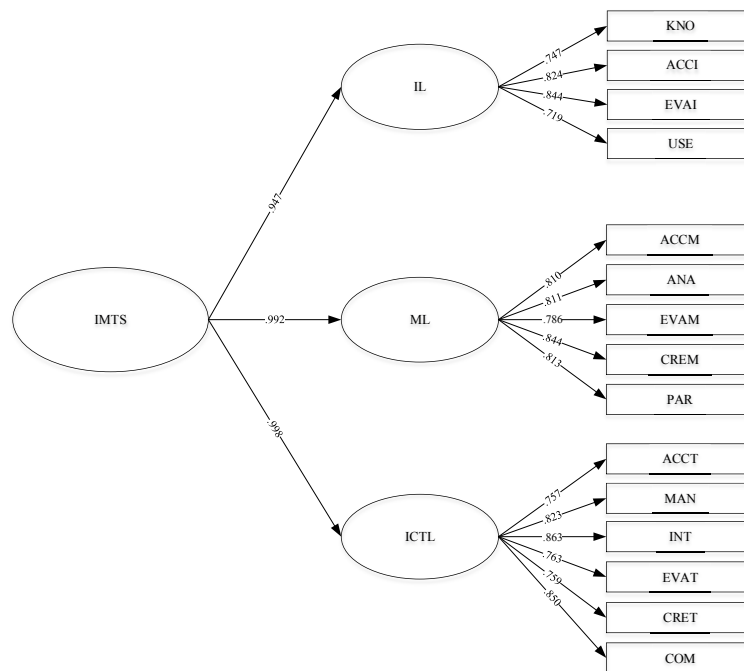
Based on the second order CFA (Figure 2), it was found that the IMTS model was composed of three components that corresponded to the empirical data. The most important element was ICT literacy (ICTL), with a factor loading of 0.998 and a  $R^2$  equal to 0.995. This was followed by information literacy (IL) with a factor loading of 0.992, and a  $R^2$  of 0.985.

**Table 6.** 2nd order CFA for the IMTX Thai student model

Latent Variable	Observed Variable	Factor loadings				
		<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	$R^2$
<i>CFA</i>						
IL	KNO	.747	<- ->	<- ->	<- ->	.558
	ACCI	.824	.055	20.321	.000	.722
	EVAI	.844	.061	19.332	.000	.721
	USE	.719	.067	15.246	.000	.517
ML	ACCM	.810	<- ->	<- ->	<- ->	.657
	ANA	.811	<- ->	<- ->	<- ->	.658
	EVAM	.786	.039	22.171	.000	.617
	CREM	.844	<- ->	<- ->	<- ->	.712
	PAR	.813	<- ->	<- ->	<- ->	.661
ICTL	ACCT	.757	<- ->	<- ->	<- ->	.573
	MAN	.823	<- ->	<- ->	<- ->	.678
	INT	.863	<- ->	<- ->	<- ->	.744
	EVAT	.763	<- ->	<- ->	<- ->	.582
	CRET	.759	<- ->	<- ->	<- ->	.576
	COM	.850	.030	34.845	.000	.722
<i>2<sup>nd</sup> Order CFA</i>						
IMTS	IL	.947	.030	25.963	.000	.949
	ML	.992	.028	35.672	.000	.985
	ICTL	.998	<- ->	<- ->	<- ->	.995

Note: Chi-Square = 57.433, df= 46, p= .120,  $\chi^2/df$  = 1.249, RMSEA = .026, RMR = .013, GFI= .980, AGFI= .947, CFI = .998

Note: bsc measures the factor loading,  $R^2$  is the coefficient of determination, the symbol <- -> indicates a mandatory parameter, so it does not report the S.E., t, and  $p$  values.



**Fig. 2.** Final model for the IMTS 2<sup>nd</sup> order CFA of Thai junior high school students  
 Chi Square =57.433, df=46,  $p = 120$ ,  $\chi^2/df = 1.249$ , RMSEA = 026, RMR = 013, GFI = 980, AGFI = .947, CFI = .998

## 5 Discussion

Investigation into the Information, Media and Technology Skills (IMTS) model involved three latent constructs including Information Literacy (IL), Media Literacy (ML), and ICT Literacy (ICTL) [10]. As anticipated and as well documented in the literature, all three components are important junior high school students.

### 5.1 ICT Literacy (ICTL)

From this study, it was determined that the most important element was ICTL. This is supported by numerous other studies, which have additionally identified problems such as poor curriculum [14], content emphasis over application in daily tasks [35], and the lack of integration with other subjects [36-37] [39]. What is also interesting to note is, that in Thailand's current Core Curriculum for Basic Education 2008, the 2008 curriculum does not support cross-curriculum learning to acquire 21st century

competencies [39]. Numerous studies have identified this as a significant problem which must be corrected. One bright side to the discussion however, is the fact that students who have access to broadband and smartphones, can leap over traditional institutional problems such as limited bandwidth, administrator control over content access, highly structured government mandated curriculums, and antiquated networks and equipment.

With *We Are Social* announcing in 2018 that Thais spend more time on the Internet than any other country in the world, one would hope that some percentage of it is spent in obtaining academic excellence and knowledge. More than half of Southeast Asia's population now uses the internet, with the number of internet users around the region growing by more than 30% – or 80 million new users – in 2017 alone. At some point there has to be a knock-on effect with education and the 'classroom', with Ormschool, the ChocChip Channel, YouTube, and Google Apps for Education starting to take hold in some institutions and classrooms in Thailand through flipped learning processes [38].

In 2016 a joint OECD/UNESCO report on education in Thailand allocated a significant part of the study to the discussion of Thailand's use of ICT in education. From that, it was reported that the success of Thailand's education system is increasingly dependent on how well it uses the potential of ICT to support students' acquisition of 21st century competencies and, on a system-wide level, better manage schools [39]. Like many countries, Thailand has implemented hardware-focused initiatives that have met with only mixed success, with a recent international assessment revealing that Thai students' ICT proficiency levels were low, and that Thai teachers lacked confidence in their own ability to use ICT. Additionally, Thailand needs to create a coherent national strategy aligning policies to enhance the use of ICT in education.

## 5.2 Media Literacy (ML)

The latent construct media literacy (ML) was identified as the second most important component in the study's IMST model. It also figures prominently in discussion concerning Thai secondary and ICT education. In a 1992 Aspen Media Literacy Leadership Institute meetings, ML was stated to be the ability to access, analyze, evaluate and create media in a variety of forms [40]. The Center for Media Literacy has since expanded the simple definition above to include a 21st century approach to education. In it, ML provides a framework to access, analyze, evaluate, create and participate with messages in a variety of forms — from print to video to the Internet. Media literacy builds an understanding of the role of media in society as well as essential skills of inquiry and self-expression necessary for citizens of a democracy [41].

As early as 2006, Pratuangsuklert also studied Thai people's perceptions of the importance of media literacy in a globalized era, in which five media literacy skills were explored [42]. These included access, analysis, evaluation, synthesis and communicative participation and production skills. Bunnag later determined that Thai youth who lived with their parents had higher ML than those who lived alone or with their relatives [43].

Today, with the internet and smartphones, ML uses a different 'toolkit'. Where TV replaced radio, and the internet replaced TV, today smartphones using high broadband capacities are replacing TVs and older forms of internet.

Today ML to today's youth is centered on social media platforms such as Line, Facebook, or WhatsApp. In Thailand, this represents 67% of the total population, who are learning an entire new language including terms such as imho, ur2, selfie, lol, etc. [44] It is also fair to say that ML has helped make Amazon's founder Jeff Bezos the richest man in the world [45], as ICTL helped make Bill Gates the richest man in the world before Jeff Bezos.

### **5.3 Information Literacy (IL)**

Finally, within IL there were four variables including awareness, accessibility, evaluation, and use [46]. The variables with the highest factor loadings were access (ACCI) and evaluation EVAI, which may be due to the student's ability to select appropriate information retrieval methods, and define effective search strategies. Online information or databases can be retrieved using a variety of methods, with information search strategies customized as needed. Also, according to Pierce, the criteria for evaluating information and information sources are validity, reliability, accuracy, and triangulation [47].

## **6 Conclusion**

The study's results for the 2<sup>nd</sup> order CFA of the IMTS model was determined by interrelationships of the three main latent constructs of IL, ML, and ICTL along with their 15 observed variables. From both the theory and the study's 2<sup>nd</sup> order CFA results, the model was determined to be solidly anchored with excellent structural integrity.

## **7 Recommendations**

1. Several frameworks used within the study are becoming dated with time and technology. Specifically, Thailand's 2008 core curriculum should be re-written to address the lack of support for cross-curriculum learning which is required as a 21st century competency.
2. Technology needs to be embraced, not ostracized from the classroom. Smartphones can be a very beneficial addition to the learning mix, but appropriate use within the classroom must be monitored.
3. Although learning management system (LMS) platforms are a welcomed feature in a 21<sup>st</sup> century, digital classroom, educators must be aware that different software entails different levels of user and technical support. Careful thought and experimentation needs to be undertaken when choosing such a system (Moodle, Edmodo,

Schoolology, etc.), which entails semesters of use and possibly many hours of IT support. Sometimes, simpler is better when it comes to cost.

4. Administrators can play a very useful role in helping with the implementation of new IMTS models using LMSs, flipped learning, broadband internet, and mediums such as YouTube....or they can be an educator's worse nightmare. Careful thought needs to be given as to how they fit in and what level of support they are willing and able to provide. Unfortunately, in Thailand, change never comes easy.

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## Appendix 1

### Student Questionnaire

Latent Variable Averages	Mean	S.D.	Skewness	Kurtosis
Information Literacy (IL) (17items)	3.61	.64	-.41	.26
Media Literacy (ML) (25 items)	3.61	.64	-.45	.60
Information and Communications Technology Literacy (ICTL) (31 items)	3.62	.65	-.40	.42

Latent and Observed Variables	Mean	S.D.	Skewness	Kurtosis
<b>Information Literacy (IL)</b>				
<i>Know (KNO)</i>				
1. I know how to find data / information.	3.64	0.80	-0.40	0.42
2. I understand how to take advantage of information.	3.50	0.79	-0.44	0.70
3. I can choose data / information from trusted sources.	3.52	0.80	-0.28	0.22
4. I can choose data / information which is accurate and up to date.	3.63	0.83	-0.42	0.18
<i>Access (ACCI)</i>				
5. I can access a variety of information resources.	3.55	0.81	-0.39	0.39
6. I can find data / information that meets the needs.	3.65	0.86	-0.40	0.29
7. I can search the Internet easily.	3.68	0.82	-0.27	-0.26
8. I know how to use various search engines such as Bing, Yahoo, and Google.	3.63	0.80	-0.31	0.16
<i>Evaluate (EVAL)</i>				
9. I can analyze the quality and reliability of source information.	3.61	0.83	-0.33	0.00
10. I can analyze the quality and reliability of data and information.	3.62	0.81	-0.27	-0.08
11. I can evaluate the quality of the source of information.	3.62	0.83	-0.30	0.01
12. I can evaluate the quality of data/information.	3.64	0.79	-0.44	0.34
13. I can evaluate critically evaluate information resources.	3.70	0.82	-0.33	0.08
<i>Use (USE)</i>				
14. I can select appropriate data / information.	3.62	0.83	-0.47	0.45
15. I am free to choose and receive data / information from various media that is creative and useful to me.	3.64	0.84	-0.21	-0.10
16. I have the ability to use ethical and moral principles to judge the value of data / information from various media sources.	3.63	0.85	-0.21	-0.14
17. I can edit and disseminate data / information effectively.	3.57	0.86	-0.73	0.93
<b>Media Literacy (ML)</b>				
<i>Access (ACCM)</i>				
18. I can choose to use the media To search information from various media including printed media such as books, newspapers, journals and electronic media such as Facebook, Line, YouTube a variety.	3.71	0.82	-0.43	0.32
19. I are able to recognize and understand the content of various information and media sources.	3.73	0.84	-0.42	0.09
20. I am free to seek information from a variety of media source (not limited to one type of media).	3.64	0.84	-0.30	0.08

<b>Latent and Observed Variables</b>	<b>Mean</b>	<b>S.D.</b>	<b>Skewness</b>	<b>Kurtosis</b>
21. I can collect information and select the type of information that is relevant and useful for my own purposes from various media channels.	3.67	0.85	-0.53	0.36
22. I can observe, memorize, understand, and explain the meaning of words, symbols, and specific techniques of effective communication.	3.53	0.90	-0.56	0.38
<i>Analyze (ANA)</i>				
23. I can distinguish facts, exaggerated offers, arguments and propaganda, persuade, motivate, present, and communicate effectively.	3.61	0.79	-0.33	0.36
24. I can distinguish the advantages and disadvantages of the presentation of the media effectively.	3.57	0.83	-0.28	0.08
25. When I decide to access information from any media, I can review the benefits and consequences for both myself and others appropriately.	3.55	0.85	-0.24	-0.06
26. I can tell or describe the main purpose and secondary purpose of comprehensive media coverage completely and accurately.	3.52	0.82	-0.19	-0.05
27. I am able to reasonably analysis media sources and information.	3.55	0.83	-0.15	-0.10
<i>Evaluate (EVAM)</i>				
28. I am free to choose whether to believe or not believe information from various media.	3.74	0.80	-0.21	-0.07
29. I can choose to receive information from the media that is creative and useful to myself and others. I can also refuse or block useless or non-creative information from the media.	3.67	0.81	-0.24	0.06
30. I know and understand the hidden information of the media in a variety of ways and can judge the accuracy, appropriateness and quality of information from those media effectively.	3.61	0.77	-0.53	0.82
31. I use moral, ethical, and democratic principles to judge the value of information from the media.	3.50	0.77	-0.37	0.69
32. I use original experience to judge the appropriateness of information from the media, based on morality and democratic principles.	3.57	0.78	-0.27	0.20
<i>Create (CREM)</i>				
33. I can design different media to represent various forms of information, knowledge, and opinions.	3.57	0.80	-0.20	0.09
34. I can present data and information in open, and straightforward and on the basis of my own responsibility and ethics.	3.54	0.81	-0.12	-0.03
35. I can produce media through planning, writing, and researching of content to properly design the media according to the format or technology of the media.	3.62	0.83	-0.41	0.29
36. I can edit and efficiently disseminate information from various media sources.	3.67	0.84	-0.45	0.18
37. I can express my opinions and suggestions creatively. I can criticize information, values, beliefs, opinions, fact, persuasiveness and propaganda. I can effectively recognize exaggerated offers that are offered through various media or covertly effectively.	3.69	0.85	-0.52	0.20
<i>Participate (PAR)</i>				
38. I engage in criticism and comment on media information in various ways to achieve s broader view.	3.60	0.82	-0.24	-0.02

Latent and Observed Variables	Mean	S.D.	Skewness	Kurtosis
39. I engage in collaborative work with others to create media that is used to disseminate accurate and useful information to society.	3.63	0.81	-0.35	0.28
40. I interact with others in critical thinking, and publicly disclose the media on the basis of responsibility and ethics.	3.52	0.84	-0.32	0.23
41. I respect the freedom to present opinions of others through various media.	3.68	0.78	-0.19	-0.32
42. I am invited to participate in critiquing, commenting, and working together in media areas.	3.69	0.81	-0.25	-0.24
<b>Information communication and technology literacy (ICTL)</b>				
<i>Access (ACCT)</i>				
43. I can use information and communication technology to access data and information.	3.68	0.83	-0.21	-0.33
44. I can find information using a variety of methods.	3.67	0.83	-0.29	-0.14
45. I can access a wide range of information via smartphones and computers.	3.62	0.83	-0.15	-0.52
46. I can search through the Internet as well.	3.66	0.83	-0.23	-0.44
47. I can search by a search engine such as Bing, Yahoo, and Google.	3.64	0.85	-0.39	0.06
<i>Manage (MAN)</i>				
48. I can choose the right information technology and communication.	3.72	0.82	-0.54	0.44
49. I can use information and communication technology to record and store data.	3.77	0.80	-0.37	0.12
50. I can install programs or applications such as Twitter, Line, and Facebook.	3.60	0.87	-0.43	0.14
51. I can install Microsoft Office on multiple platforms.	3.70	0.83	-0.38	0.21
52. I use antivirus programs to check data files.	3.56	0.87	-0.46	0.22
53. I can copy data from the hard disk to the backup.	3.50	0.85	-0.26	-0.02
<i>Integrate (INT)</i>				
54. I can apply information and communication technology to create new work.	3.57	0.83	-0.35	0.22
55. I can synthesize information technology and communication to create new ideas.	3.59	0.84	-0.42	0.25
56. I can solve problems caused by the use of ICT.	3.58	0.84	-0.41	0.32
57. I can use Microsoft Word to produce reports fluently.	3.57	0.88	-0.40	0.15
58. I am able to use Microsoft Excel to present data tables in a fluent manner.	3.64	0.80	-0.40	0.42
59. I am very familiar with Microsoft PowerPoint and can use it fluently.	3.50	0.79	-0.44	0.70
<i>Evaluate (EVAT)</i>				
60. I understand the purpose, scope and suitability of Information Communication Technologies.	3.52	0.80	-0.28	0.22
61. I can describe and apply basic ICT.	3.63	0.83	-0.42	0.18
62. I can evaluate the use of ICT.	3.55	0.81	-0.39	0.39
63. I can safely use ICT technologies.	3.65	0.86	-0.40	0.29
64. I understand the value and benefits of ICT.	3.68	0.82	-0.27	-0.26

Latent and Observed Variables	Mean	S.D.	Skewness	Kurtosis
<i>Create (CRET)</i>				
65. I can use information and communication technologies such as letters, pictures, animations, and sounds to create a piece of work.	3.63	0.80	-0.31	0.16
66. I can be creative when I design information and communication technologies.	3.61	0.83	-0.33	0.00
67. I can use a variety of solutions to solve new problems.	3.62	0.81	-0.27	-0.08
<i>Communicate (COM)</i>				
68. I can use social networks to comment on topics.	3.62	0.83	-0.30	0.01
69. I can share my creativity to others through the Internet and social networks.	3.64	0.79	-0.44	0.34
70. I can use a variety of media to share resources with others.	3.69	0.81	-0.25	-0.24
71. Classmates have the ability to select and integrate various medias/tools to convey and exchange ideas.	3.68	0.83	-0.21	-0.33
72. I can communicate and exchange information through various media such as the Internet, mobile phones, which works well.	3.67	0.83	-0.29	-0.14
73. I can communicate with others via social networks such as Twitter, Line, and Facebook.	3.62	0.83	-0.15	-0.52