

The Factor Analysis of Digital Emotional Intelligence Among Adolescent Students in Bangkok

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Abstract This research aimed 1) to study the indicators of digital emotional intelligence of adolescent students 2) to investigate the concordance of digital emotional intelligence model with empirical data. The sample used in the study were adolescent students studying in the secondary school in the academic year 2022 in Bangkok from the Secondary Educational Service Area Office 1, Secondary Educational Service Area Office 2, office of Bangkok, and Office of the Ministry of Higher Education, Science, Research and Innovation. The sample group included ten key informants and 400 students. They were chosen by multiple random sampling. The research instrument used for collecting data was a digital emotional intelligence questionnaire with 30 items. The data were analyzed by confirmatory factor analysis. The research results were found as follows; 1) The components of digital emotional intelligence of adolescent students consisted of 5 components: self-awareness, self-regulation, self-motivation, interpersonal skills, and empathy. 2) The digital emotional intelligence model by the empirical. All variables were appropriate as observed variables of digital emotional intelligence.

Keywords Digital emotional intelligence; Factor analysis; Adolescent students

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Introduction

Digital intelligence quotient or DQ is a vital variable in the digital world, which young people need to learn. It is a comprehensive technical, cognitive, meta-cognitive, and socio-emotional competencies grounded in universal moral values. It resulted from the study and development of DQ Institute in collaboration with government and private sectors worldwide that aim to promote children to become quality digital citizens and live safely. In total, Digital Intelligence is an eight-by-three matrix of 24 competencies. Digital Emotional Intelligence is 1 of the 8 parts of Digital Intelligence that can create good relationships with others through digital media. (DQ Institute, 2019). According to the 2018 report on Thai children and youths conducted by DQ Institute among 37,967 children and youths aged 8-12 years, it was found that Thai children and youths had a 60% chance of encountering cyber threats, which was higher than the global average compared to 29 countries across the world. Thai children spend 35 hours per week on the internet. Therefore, they are a risk group affected by various digital threats (Bangkokbiznews, 2018). This is consistent with a study conducted by the Internet Foundation for the Development of Thailand on Thai children's situation with cyber threats in 2020. The sample consisted of 14,945 high school students aged 12-18 years. It was found that the most common cyber threat was cyberbullying, a type of bullying using digital technologies (Digital Economy Promotion Agency, n.d.). Thailand is ranked number 5 in the world for cyberbullying problems in educational institutions; it is a common problem nowadays. A variety of factors cause it because adolescent students in secondary school still lack emotional and social maturity. The widespread use of the internet and social media, makes you unable to control emotions and behavior. When conflicts arise, there will be more violent verbal confrontations. Since communication in the digital world comes in brief messages or texting; there is no emotional connection, and people are cannot guess what emotion another person is feeling in this regard, a quarrel can occur in the cyber world more quickly than in the real world. Children in the digital era have decreased emotional intelligence (Thai Media Fund, 2021). Sooner or later, the digital and real worlds will merge. Children have to confront various risks. Therefore, children should be prepared for the digital world (Park, 2016), Digital intelligence quotient (DQ) has become one of the critical 21st- century skills required by children and youths.

Park (2016) studied and defined the digital intelligence quotient in the digital world as being empathetic and building healthy online relationships with other people. It is consistent with the DQ Institute (DQ Institute, 2019), stating that it is recognizing, navigating, and expressing emotions in one's digital intra- and inter-personal interactions. According to UNESCO Digital Kids Asia-Pacific (UNESCO Digital Kids Asia-Pacific, 2019), DQ is the ability to recognize, and express emotions and use emotional quotient through digital communication to interact with others.

The findings from documents and research in foreign countries, relevant to components of digital emotional intelligence-indicate that there are various important components in digital emotional intelligence as follows: DQ Institute (DQ Institute, 2017) proposed that there are 3 major components in adolescent students' digital emotional intelligence, namely, 1) social and emotional awareness, 2) emotional awareness/regulation, and 3) empathy (DQ Institute, 2017). In 2019, DQ Institute developed the components of digital emotional intelligence in 3 levels, 3 components, i.e. Level 1 – Digital Citizenship is the ability to be aware of, be sensitive to, and be supportive of one's own and other's feelings, needs and, concerns (Digital Empathy). Level 2 – Digital Creativity is self-awareness and management; Level 3 – Digital Competitiveness is relationship management (DQ Institute, 2019). The National University of Singapore describes there are 3 components and 3 levels of digital emotional intelligence, i.e. Level 1 – Digital Skills consist of emotional literacy, Level 2 – Digital Identity is related to empathy, and Level 3 – Digital Empowerment and Agency is associated with solitary and relationship management (Yue et al., 2021). In addition, Digital Kids Asia-Pacific proposes that there

are 5 components in digital emotional intelligence self-awareness, self-regulation, self-motivation, interpersonal skills and empathy (UNESCO Digital Kids Asia-Pacific, 2019).

The study on concepts and theories related to digital emotional intelligence among adolescent students indicated that the components of digital emotional intelligence proposed by the DQ Institute and the National University of Singapore give importance to economic change in the digital era. Therefore, the researcher was interested in studying the digital emotional intelligence of Digital Kids Asia-Pacific since its framework covers the education of adolescent students. Its components are consistent with Thai students, i.e. self-awareness, self-regulation, self-motivation, interpersonal skills, and empathy and can be used as the research conceptual framework for studying components in adolescent students.

The study on components of digital emotional intelligence in adolescent students shall bring about clarity and accuracy of components of digital emotional intelligence. Meanwhile, components of digital emotional intelligence in adolescent students in Bangkok found in the research can be used as a guideline for developing learning management of integrated guidance activities to enhance digital emotional intelligence in adolescent students in the next phase of the research.

Research objectives

1. To study indicators in confirmatory factors of digital emotional intelligence in adolescent students.
2. To verify the consistency between the measurement model of digital emotional intelligence in adolescent students and empirical data.

The scope of the study

Content scope - The study was conducted to analyze components of digital emotional intelligence in adolescent students of secondary schools in Bangkok.

Scope of population and sample - the population in the study included adolescent students of secondary schools in Bangkok, the academic year 2022, under the supervision of the Secondary Educational Service Area Office Bangkok 1, under the supervision of the Secondary Educational Service Area Office Bangkok 2, Office Bangkok and the supervision of Ministry of Higher Education, Science, Research and Innovation. There are 67 schools under the supervision of the Secondary Educational Service Area Office Bangkok 1 (The Secondary Educational Service Area Office Bangkok 1, 2022), 63 schools under the supervision of the Secondary Educational Service Area Office Bangkok 2 (The Secondary Educational Service Area Office Bangkok 2, 2022), 109 schools under the supervision of Bangkok Metropolitan Administration (Department of Education, Bangkok Metropolitan Administration, 2021) and 12 schools under the supervision of Ministry of Higher Education, Science, Research and Innovation (Wikipedia, 2022), 165,326 persons in total.

Area scope - secondary schools in Bangkok under the supervision of the Secondary Educational Service Area Office Bangkok 1, under the supervision of the Secondary Educational Service Area Office Bangkok 2, under the supervision of Bangkok Metropolitan Administration and under the supervision of the Ministry of Higher Education, Science, Research and Innovation.

Timing scope - the study was conducted from 26 September 2022 to 31 January 2023.

Literature review

Preliminary guidelines for studying components of digital emotional intelligence from the concept proposed by Digital Kids Asia-Pacific, i.e., self-awareness, self-regulation, self-motivation, interpersonal skills, and empathy (UNESCO Digital Kids Asia-Pacific, 2019).

The results obtained from an in-depth interview with experts, specialists, and adolescent students of junior secondary schools from phase 1 of the research on components of digital emotional

intelligence in adolescent students revealed that significant components of self-awareness, self-regulation, self-motivation, interpersonal skills, and empathy, in conjunction with the concept of digital emotional intelligence proposed by Digital Kids Asia-Pacific (UNESCO Digital Kids Asia-Pacific, 2019). The is the ability to recognize and express emotions to interact with other people through digital channels.

Research methodology

The study used a mixed+ method research design to learn about components of digital emotional intelligence in adolescent students. Details are as follows:

Determination of population and sample

(1) The population in the research includes adolescent students studying in the academic year 2022 in junior secondary schools in Bangkok under the supervision of the Secondary Educational Service Area Office Bangkok 1, under the supervision of the Secondary Educational Service Area Office Bangkok 2, under the supervision of the Bangkok Metropolitan Administration, and the supervision of the Ministry of Higher Education, Science, Research and Innovation. There are 67 schools under the supervision of the Secondary Educational Service Area Office Bangkok 1, 63 schools under the supervision of the Secondary Educational Service Area Office Bangkok 2, 109 schools under the supervision of Bangkok Metropolitan Administration and 12 schools under the supervision of Ministry of Higher Education, Science, Research and Innovation.

(2) The sample used for studying components to make a measurement model of digital emotional intelligence in adolescent students using confirmatory factor analysis (CFA) included adolescent students in the academic year 2022 in junior secondary schools in Bangkok. The sample size should be five to ten times the number of indicators. (Kaiyawan, 2014) Therefore, the sample consisted of 400 persons.

Table 1 Number of samples of students studying in the secondary school in Bangkok

Affiliation	Number of schools	Classroom	Number of students
The supervision of the Secondary Educational Service Area Office Bangkok 1	2	4	100 Students
The supervision of the Secondary Educational Service Area Office Bangkok 2	2	4	100 Students
The Office Bangkok	2	4	100 Students
The Office of Ministry of Higher Education, Science, Research and Innovation	2	4	100 Students
Total	8	16	400 Students

How to make the research instrument - The instrument used for confirmatory factor analysis of digital emotional intelligence in adolescent students is a digital emotional intelligence scale developed by the researcher using a Likert 5 –5 rating scale. The procedures for making the instrument are as follows:

(1) Study documents and research relevant to digital emotional intelligence in adolescent students to learn about digital emotional intelligence concepts, theories, definitions, and components.

(2) Conduct an in-depth interview with key informants from interviews with five experts and five adolescent students in secondary school. The researcher made a guideline for asking questions for a semi-structured interview. The guideline for questioning was made from studying documents

related to digital emotional intelligence and concluded as components of digital emotional intelligence in adolescent students. The steps are as follows

(2.1) Draft questions for the interview on Digital Emotional Intelligence.

(2.2) Take the interview data on Digital Emotional Intelligence to check the content validity measurement and evaluation.

(2.3) Improve the interview form according to expert suggestions before actually using it.

(3) Write a definition of terms of digital emotional intelligence in adolescent students to cover all variables in the study and make questions for the digital emotional intelligence scale (Likert 5 – rating scale). There are 30 question items.

(4) The developed digital emotional intelligence scale was submitted to 5 experts to examine the congruence between questions and definition of terms in each item to find an index of item objective congruence (IOC) between questions and operational definition. The question items had IOC ranging from 0.60 to 1.00. The question items were improved according to experts' advice to ensure the instrument has better quality.

(5) The improved digital emotional intelligence scale was pretested with 90 adolescent students who were not the actual sample to analyze the discrimination power of each question item. An item-total correlation test was performed, and the item discrimination index ranged from 0.27 to 0.74. The reliability of the digital emotional intelligence scale measured by Cronbach's alpha coefficient was 0.91.

(6) The digital emotional intelligence scale was used to collect data from the real sample to perform a confirmatory factor analysis of digital emotional intelligence in adolescent students.

Steps to conduct the research

Research steps were conducted as follows:

(1) Study documents and research relevant to digital emotional intelligence in adolescent students. An in-depth interview was conducted with key informants to make a digital emotional intelligence scale.

(2) The researcher contacted schools as the sample in the study to ask for their assistance and permission to collect data from adolescent students.

(3) The developed digital emotional intelligence scale was used to get answers from the sample. The sample consisted of adolescent students studying in junior secondary schools in Bangkok, selected by simple random sampling.

(4) The data obtained from the (3) were examined and given scores before confirmatory factor analysis (CFA) was performed.

(5) Components of digital emotional intelligence in adolescent students obtained from the confirmatory factor analysis and significant indicators were summarized for studying and enhancing digital emotional intelligence in adolescent students in Bangkok in the next phase.

Data collection

Methods for data collection were employed according to the research objectives as follows:

(1) The letter requesting the cooperation of research from the Graduate School of Srinakharinwirot University was submitted to school administrators to ask for assistance in collecting data from the research sample.

(2) The digital emotional intelligence scale was used to collect data from adolescent students studying in junior secondary schools, in Bangkok in 2022 according to the number of samples determined.

(3) The digital emotional intelligence scale was examined for accuracy to perform confirmatory factor analysis (CFA). The accurate digital emotional intelligence scale was used to perform data distribution.

Data analysis

Confirmatory factor analysis (CFA) was performed to analyze quantitative data to assess the fitness of the measurement model of digital emotional intelligence in adolescent students–by the hypothesis and empirical data. Maximum likelihood estimation was used for estimating parameters, considered from Chi-square values; non-statistical significance Chi-square values having the goodness of fit index (GFI) and the adjusted goodness of fit index (AGFI) greater than 0.90 and having the standardized root mean squared residue (SRMR) and the root mean square error of approximation (RMSEA) less than 0.05.

Table 2 Study results of indicators in the components of digital emotional intelligence in adolescent students

Components of digital emotional intelligence in adolescent students	Indicators of digital emotional intelligence in adolescent students
1. Self-awareness	1. Perceive and understand one's own emotions and feelings,
2. Self-regulation	2. Describe one's own emotions and feelings
3. Self-motivation	1. Reflective thinking
	2. Manage one's own emotions and feelings
	3. behavioral control
	4. Assertiveness
	1. Patience and perseverance
	2. Positive attitude
	3. Self-encouraged and encourage others
	4 Self-leadership
	5. Ability to make use of online media
4. Interpersonal skills	1. Communication skills
	2. Understand communication through different channels
	3 Express opinions appropriately.
5. Empathy	1. Perceive emotions and feelings of others
	2. Understand feelings of others
	3. Express one's feelings to others.

Research results based on Objective 1 – The study on indicators in confirmatory factors of digital emotional intelligence in adolescent students. The study results revealed that digital emotional intelligence in adolescent students consists of 5 components, i. e. self-awareness containing 2 indicators: 1. Perceive and understand one's own emotions and feelings, 2. Describe one's emotions and feelings, self-regulation containing 4 indicators; 1. Reflective thinking, 2. Manage one's emotions and feelings, 3: behavioral control, and 4. Assertiveness and self-motivation contain 5 indicators: 1. Patience and perseverance, 2. Positive attitude, 3. Self-encouraged and encouraged others, 4. Self-leadership, 5. The ability to use online media and interpersonal skills contain 3 indicators: 1. Communication skills, 2. Understand communication through different channels: 3. Express opinions

appropriately, and empathy contains 3 indicators: 1. Perceive emotions and feelings of others, 2. Understand the feelings of others, 3. Express one's feelings to others, as seen in Table 2.

Objective 2 – Verifying the consistency between the digital emotional intelligence measurement model in adolescent students and empirical data. The study results revealed that the correlation coefficient ranged from 0.386 to 0.499 with a statistical significance level of 0.01, showing that the variables in the study were adequately correlated to be used for analyzing the confirmatory factors. The confirmatory factor analysis results of the measurement model of digital emotional intelligence in adolescent students were consistent with the empirical data, considered from Chi-square values that were different from zero and not statistically significant, GFI was 0.95, AGFI was 0.92, RMSEA was 0.046. Consideration of the criterion weight of all 5 components of digital emotional intelligence found that factor loadings of the components of digital emotional intelligence in adolescent students ranged between 0.72 and 1.08. Interpersonal skills had the maximum standard weight equal to 0.98, followed by self-motivation, empathy, self-awareness, and self-regulation had the criterion weight to measured variables in the form of standard weights equal to 0.98, 0.95, 0.86, and 0.71, respectively, as seen in Table 3 and Table 4. The digital emotional intelligence scale was tested the consistency between the model and the empirical data using confirmatory factor analysis, and measured construct validity. Initially, the model was not consistent with the empirical data. Adjustments were made until the model was consistent with the empirical data, as seen in Table 5.

Table 3 Correlation coefficient of digital emotional intelligence in adolescent students by the components

	AW	RE	MO	IN	EM
AW	0.716				
RE	0.462**	0.719			
MO	0.365**	0.440**	0.761		
IN	0.451**	0.418**	0.499**	0.770	
EM	0.386**	0.347**	0.489**	0.450**	0.722

Remark: * $p < .05$, ** $p < .01$, (n = 400)

Diagonal values in the matrix are measure of sampling adequacy (MSA)

Table 4 Confirmatory factor analysis results of the measurement model of digital emotional intelligence in adolescent students

Components of digital emotional intelligence	No. of items	B value range	Factor loadings				C.R.
			B	SE	t	SC	
Self-awareness	6	0.37-0.55	0.83	0.07	11.28**	0.86	0.74
Self-regulation	6	0.31-0.72	0.72	0.07	9.59**	0.71	0.50
Self-motivation	6	0.18-0.51	1.08	0.11	9.87**	0.98	0.96
Interpersonal skills	6	0.21-0.57	0.85	0.08	11.02**	0.98	0.97
Empathy	6	0.17-0.64	0.86	0.08	11.17**	0.95	0.90

$\chi^2 = 338.99$ df = 302, $p = .070$, GFI = .95, AGFI = .92, CFI = .99, SRMR = .045, RMSEA = .018

Remark: FS refers to factor score regression, SC refers to completely standardized solution, C.R. refers to construct reliability.

1.. 2.. 3.. 4. 5.

Table 5 Goodness of fit index and comparison index of the measurement model of digital emotional intelligence in adolescent students

Index	Criteria	Statistics in the model
χ^2	No statistical significance or χ^2 / df is not greater than 2.	$\chi^2 = 338.99$ ($p=0.070$), $df=302$ $338.99/302 = 1.122$
GFI	> .90	0.95
AGFI	> .95	0.92
CFI	> .95	0.99
RMSEA	< .05	0.018
SRMR	< .05	0.018

According to Table 4, the verification results of the consistency of the measurement model of digital emotional intelligence in adolescent students, χ^2 was 338.99 and the statistical significance level (p) was 0.0707. It can be seen that χ^2 was not statistically significant. The empirical data were consistent with the measurement model of digital emotional intelligence in adolescent students, which has 5 components: self-awareness, self-regulation, self-motivation, interpersonal skills, and empathy.

Conclusion and discussion

Research results based on Objective 1 - The study on indicators in confirmatory factors of digital emotional intelligence in adolescent students from interviews with five experts and five adolescent students in secondary school. When using the issues obtained from content analysis from the interviews and information obtained from the synthesis of the concept of digital emotional intelligence of adolescent students. The definition of the meaning of Digital emotional intelligence refers to the ability to perceive and be aware of your own emotions and understand the feelings of other people, be able to use knowledge in managing emotions appropriately, be motivated to express your self positively, as well as create and maintain relationships between others through digital channels appropriately found that there are 5 components of digital emotional intelligence, i. e. self-awareness, self-regulation, self-motivation, interpersonal skills, and empathy. Self-awareness is the ability to perceive and understand one's thoughts, emotions, and feelings when confronting various situations before or after using the internet, including explaining one's emotions to others in the digital world. Self-regulation is the ability to express one's reflective thinking and how to control and manage one's own emotions appropriately when encountering situations in the digital world that are not desirable Self-motivation is the ability to create one's drive, self-leadership, perseverance and patience, positive attitude, and the ability to motivate other people and online media creatively. Interpersonal skills include using digital communication skills to communicate with others through online digital media. The communication takes place between message receivers and message senders through different channels at the same time, and the communication that takes place between message receivers and message senders at different times causes message exchange, such as image messages, voice messages, emoticons, greetings, introducing other people first, expressing opinions using polite words. Empathy is the ability to understand and share the feelings of others in digital communication and the ability to understand other people's feelings that they are facing online. This is consistent with Digital Kids Asia-Pacific (Digital Kids Asia-Pacific, 2019) stating that all 5 components of digital emotional intelligence are basic classroom skills that encourage students to see the importance of putting themselves in someone's place/positive/shoes and human relations skills. A study by DQ Institute (DQ Institute, 2019) mentioned that digital emotional intelligence focuses on the ability to perceive and express emotions-and interact with other people online.

Research results based on Objective 2 – Verifying the consistency between the digital emotional intelligence measurement model in adolescent students and empirical data. According to the confirmatory factor analysis of digital emotional intelligence in adolescent students χ^2 was, the statistical significance level (p) was 0.0707. It can be seen that χ^2 was not statistically significant. It can be interpreted that the empirical data were consistent with the measurement model of digital emotional intelligence in adolescent students. Consideration of the relative Chi-square found it was 1.122, less than 2.000, showing that the measurement model of digital emotional intelligence in adolescent students was consistent with the empirical data. (Kaiyawan, 2014) In addition, other fit indices were considered, such as the Goodness of Fit Index (GFI) is a statistical measure used to assess how well an observed set of data fits a particular model was 0.95; adjusted Goodness of Fit Index (AGFI) is an improvement over the Goodness-of-Fit Index (GFI) was 0.92, Comparative Fit Index (CFI) is another important statistic used to assess how well a model fits the data was 0.99, showing that the measurement model of digital emotional intelligence in adolescent students was consistent with the empirical data. Besides, the Standard Root Mean Square Residual (SRMR) is another key statistic used to assess model fit was 0.045; the Root Mean Square Error (RMSEA) a statistical measure used to assess the goodness of fit of a model, was 0.018: the bounded below by zero. Those indices revealed that digital emotional intelligence in adolescent students includes 5 components: self-awareness, self-regulation, self-motivation, interpersonal skills and empathy.

Consideration of the criterion weight of all 5 components of digital emotional intelligence found that factor loadings of the components of digital emotional intelligence in adolescent students ranged between 0.72 and 1.08. Interpersonal skills had the maximum standard weight equal to 0.98, this may be because Interpersonal Skills are an important component of adolescent development in which peer groups, therefore Interpersonal Skills in the digital world are sixth factor in the lives of adolescent students, consistent with the Bar-on model (Bar-on, 1997) mentioning that interpersonal relationship skills are characterized by giving and receiving warmth and affection and conveying intimacy when appropriate, consistent with what Damchab (2017) stated that communication in the digital era requires good science from communicators, creative but correct information, proper manner and ethics in using digital media to ensure communication in the society is full of creativity and maximum benefits, consistent with Kopelman-Rubina et al. (2022) studied Social-Emotional Learning focuses on Interpersonal Communication has been found to develop effective Interpersonal Skills in children cause learning it is the way to create success and readiness for children's lives. Self-motivation, empathy, self-awareness, and self-regulation had the criterion weight to measured variables in the form of standard weight equal to 0.98, 0.95, 0.86, and 0.71, respectively.

The research indicated the components of digital emotional intelligence in adolescent students of junior secondary schools in Bangkok. Adolescent students have digital emotional intelligence and can respond to what is happening in the digital world. This is consistent with Inthanon (2020), stating that promoting moral values and ethics in using of technology among students will establish strong emotional bonds between internet users to perceive thoughts and feelings of people bullied and turn to take care of each other more and more.

Suggestions

From the findings, the suggestions are as follows:

1. Suggestion from the research results

The confirmatory factor analysis revealed 5 components of digital emotional intelligence in adolescent students. The developed digital emotional intelligence scale has high validity, which can be modified to be used with other people with similar characteristics to the research sample to measure digital emotional intelligence in adolescent students. With this tool, students can check if they have a

high level of digital emotional intelligence. Those who wish to use the developed digital emotional intelligence scale should study the scoring criteria of the scale so that it can be used correctly.

2. Suggestions for future research

1. An additional study should be conducted on other factors affecting digital emotional intelligence in adolescent students, being a part of developing digital emotional intelligence in adolescent students more efficiently.

2. A group consultation model should be developed to enhance digital emotional intelligence in adolescent students by using various techniques or methods to help the students have more digital emotional intelligence.

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