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Thai undergraduate digital citizenship skills education: A second-order confirmatory factor analysis

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Abstract

From the study's initial qualitative analysis, 10 latent variables and 22 indicators concerning digital citizenship skills (DCS) were used in a questionnaire on a sample of 506 Thai Business Computer Programme undergraduate students attending one of six regional Thai Rajabhat Universities. Goodness-of-fit and descriptive statistical analysis [mean, standard deviation, Kaiser–Meyer–Olkin index analysis and Bartlett's test of sphericity were analysed by using SPSS® for Windows Version 21 and LISREL 9.10 for the second-order confirmatory factor analysis CFA. The results revealed that each student's opinion on their DCSs had a 'high agreement' level. Moreover, importance ranking from high to low of the 10 primary indicators was each student's footprint (1.00), cyberbullying (1.00), law (0.97), access (0.88), security (0.84), literacy (0.83), empathy (0.81), etiquette (0.80), collaboration (0.70) and thinking (0.65). Therefore, it is suggested that this study's results be used to assist various agencies and ministries in building programmes for student digital citizenship skills.

Keywords: Digital skills education; student cyberbullying; student digital footprints; teaching digital literacy; Thailand

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1. Introduction

In Thailand, digital transformation is moving to the forefront in the strategic planning for a multitude of organisations, government agencies and educational institutions, with technology, media, telecommunications and financial services leading the charge in providing services to their consumer base of digital citizens (Deloitte, 2020). Those who are making the digital transformation will become market leaders, while others who do not make the shift, will struggle to survive.

Therefore, understanding what factors a new generation of digital citizens embrace and understand becomes crucial across a wide spectrum of educators and their institutions, government officials and human resource personnel (Phuapan et al., 2016). Moreover, research from Cornell University has highlighted the critical importance to a nation's youth and listed the skills needed for *digital literacy* (DL) as the ability to *locate, utilise, evaluate, share* and *create content* from the use of information communication technologies (ICT) and the Internet (Steele, 2009) (Figure 1).

As far back as 1997, Gilster (1997) described DL as the ability to use and understand information in various formats from a variety of different computer sources. Additionally, it has been noted that this new 'digital generation' are youth who were born in or after 1980 (Millennial Generation and Generation Z) (Palfrey & Gasser, 2008; Reeves & Oh, 2008).

Moreover, as we shall see, the use of the terms information literacy (IL) and DL has become almost interchangeable (Horton, 2007; Moto et al., 2018). To help guide this elite group, various global organisations and agencies have been established to catalogue and understand which factors play a role in a global citizen's use of the Internet and digital technology. Or in other words, what factors constitute good digital citizenship skills (DCS)?

1.1. Conceptual framework

Ribble (2015) has outlined nine aspects (Figure 1) and later three categories (respect, educate and protect) that the author states that all students should know to help them understand what is required to obtain good DCS (Ribble, 2020). Moreover, the author contends that since children have always been exposed to technology, their teachers today assume they have high levels of competence in their use.

However, this is not true in too many cases. Moreover, as more and more scholars are pointing out, student comfort in using technology is not the same as using the technology and the Internet appropriately (Garcia-Umana & Tirado-Morueta, 2018; Pimdee & Leekitchwatana, 2019; Purnama et al., 2021). However, obtaining good digital literacy can help students in the identification of online risks (Helsper & Smahel, 2020).

Another well-recognised individual who has also added to the literature concerning ethical issues in Internet use is the theorist Howard Gardner who penned the *Theory of Multiple Intelligences* (Logan, 2016). However, Gardner also identified five factors which he felt children needed to be made aware of when using the Internet and websites online, including their privacy, their identity information, their credibility ownership and their Internet and social media participation (Gardner & Davis, 2013).

Thereafter, Dr Gardner collaborated with Harvard University which led to the creation of the *Good Play Project* with *Common Sense Media* (CSM) to create an expanded literacy curriculum on digital citizenship and digital ethics based on the factors outlined by Gardner's five core values and the expanded elements shown in Figure 1. Finally, CSM is involved in creating digital citizenship curriculums which are based on privacy, security and safe information.

Choi (2016) has also added to the DCS research and determined that there were four categories, including *ethics* (C1), *media and information literacy* (C2), an individual's *engagement and participation* (C3) and their *critical resistance* (C4) (Figure 1). Briefly outlined, C1 is conceptualised in terms of a user's safe, ethical and responsible Internet engagement; C2 is the ability of Internet users to access the Internet, evaluate information, communicate, cooperate and/or collaborate with others; C3 is their ability to participate and engage in all aspects and levels of societal-based activities; and finally, C4 is the ability to 'push back' and challenge the status quo and promote social justice from the use of the Internet.

The authors state that Internet activities from the *Arab Spring* and *Occupy Wall Street* are examples of C4. Later, Choi et al. (2017) created a DCS which was composed of 26-items in a five-factor model. According to the authors, their model was a more complex, 'transactive portrait' of how individuals live online based on the emerging psychological and sociological theories of Internet behaviour.

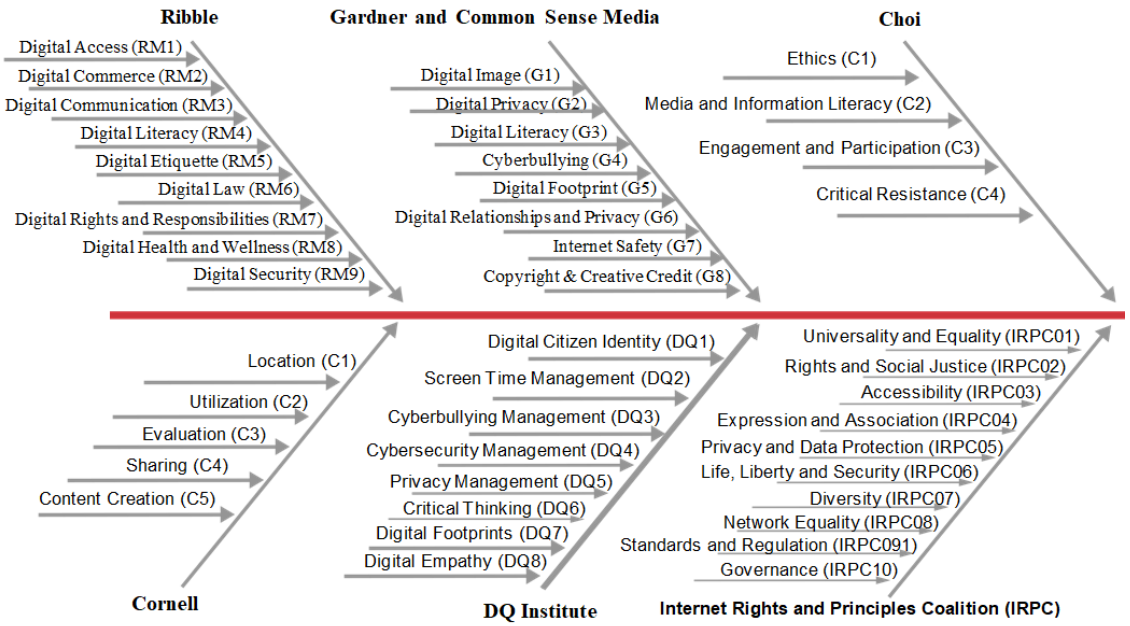

Figure 1. Digital citizenship skills (DCS)

The DQ Institute (2017) also conceptualised a framework for digital citizenship which entailed the eight attributes shown in Figure 1, whose explanation is expanded and shown in Figure 2. Moreover, the framework is stated to be rooted in an individual's values, including *empathy*, *respect* and *discernment*.

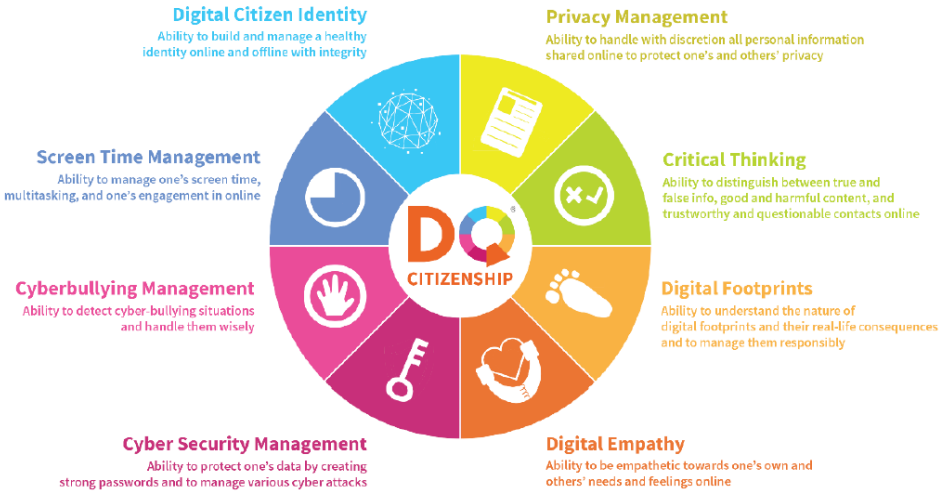

Figure 2. The DQ Institute digital citizenship skills (DCS) and descriptions

Finally, the *Internet Rights and Principles Coalition (IRPC, 2021), was* created by individuals and organisations who wished to establish an open consortium in which an individual's Internet and human rights are outlined in the *Charter of Human Rights and Principles for the Internet*. Also, IRPC goes to great lengths to communicate their mission on a global scale and as of mid-2021 have translated their charter into 26 languages.

In the IRPC's international charter, 10 concepts for Internet rights and principles and DCS are outlined in Figure 1 in IRPC01–IRPC10. Based on the *UN Internet Governance*, the charter sets forth the idea that the Internet is a powerful tool in offering unprecedented opportunities for the realisation of a citizen's human rights. Therefore, both private and public sectors must protect and preserve citizen rights on the Internet.

Moreover, Tejedor et al. (2020) have further noted from their analysis of students from three countries on two continents that there is a need to enhance digital skills, especially during the current COVID-19 pandemic. This is also consistent with Yustika and Iswati's (2020) study, which determined that digital literacy has a positive and significant effect on student academic achievement and student outcomes.

In a conference conducted by the Council of Europe on digital citizenship education (DCE), a definition of DCE was compiled from a search of the literature of digital citizenship since 2000. From that, the conference concluded that DCE entailed three major components; they included *digital engagement*, *digital responsibility* and *digital participation* (Gerhard & Rapporteur, 2017).

Interestingly, the conference tackled the confusion between online safety and the values and attitudes which one should have while using the Internet and stated the simple answer which came from an 11-year-old participant who stated that '*digital citizenship is the code on how to act and internet safety is the troubleshooting'* (Gerhard & Rapporteur, 2017, p. 12).

In Thailand, the government has put ever greater emphasis on ICT and digital technologies as a foundation to bring about social stability and economic wealth (Thailand Digital Economy and Society

Development Plan, 2018). Moreover, a '*Digital Thailand*' is envisioned as raising digital capacity and competitiveness, while also reducing digital inequalities in education, healthcare, ICT access and income distribution. Also very interestingly, the Thai government sees digital technology as a tool to fight corruption, increase transparency and civic engagement through open data.

1.2. Related research

As previously stated, Thai youth, from early learners to student teachers, have been a target of numerous studies on their appropriate Internet use and what factors constitute good DCSs (Moto et al., 2018; Phuapan et al., 2016; Pimdee & Leekitchwatana, 2019). Therefore, from the overview of the literature from the scholars and organisations discussed, we identified 12 primary factors which we feel play a significant role in Thai Business Computer Programme (BCP) undergraduate DCS (Table 1). Inclusion determination was based on the study of synonyms of similar elements in which two or more organisations or academics had included the concept in their writings.

Table 1. DCS literature synthesis

Table 1. DCS Literature Synthesis

DCS Components	Ribble	Gardner and Common Sense Media	Choi	Cornell	DQ Institute	IRPC	Council of Europe
Digital engagement, communications, and information exchange.	✓	✓	✓	✓		✓	✓
Learning technology transfer	✓	✓		✓			
Digital commerce	✓			✓			
Critical thinking skills		✓	✓		✓		
Internet access equality	✓		✓			✓	✓
Privacy and security management		✓	✓		✓	✓	✓
Internet time use management					✓		
Protecting your digital footprint and digital reputation	✓	✓			✓	✓	✓
Digital law knowledge	✓	✓	✓			✓	✓
Digital etiquette and ethics	✓	✓	✓			✓	✓
Digital Empathy	✓				✓	✓	✓
Cyberbullying management	✓	✓			✓	✓	✓

1.3. Statement of the problem

According to the World Bank (2019), Thailand, in 2019, had achieved a 66.7% Internet penetration rate for its nearly 70 million citizens. Comparatively, the Philippines for the same period had only a 43.0%. Also, according to data use information published by Statista in 2021, Thai Generation Z

Internet users (less than 19 years old) used the Internet an average for *12.8 hours per day online* (Manakitsomboom, 2021).

Even more surprising, their older sisters and brothers who belonged to Generation Y (19–38 years old) were spending an average of *12.26 hours per day online*. As such, we felt that there is an overwhelming need to investigate which aspects of the Kingdom's youth and young adults were important in the development of their DCSs. Therefore, we set out to define and investigate which factors played the greatest and least roles in Thai BCP studies of undergraduate students who were studying in one of six Thai regional Rajabhat universities.

2. Methods

The Human Ethics Committee from our research university was notified and consulted before meeting with experts concerning the questionnaire's design and the questionnaire's pre-test. Along with the committee's approval, we obtained an informed consent form from each survey participant which stated that each participant's anonymity was ensured (Chuenban et al., 2021).

2.1. Population and sample

The initial population for the study was 9,265 undergraduate students who were majoring in the BCP at one of a total of 38 Thai Rajabhat Universities in the 2020 academic year (Higher Education Information Dissemination System, 2020). After a review of the literature related to sample sizes and collection methods, we adopted the principles set out by Osborne and Costello (2004), who indicated that researchers conducting CFA studies can adopt a method in which a ratio of 10–20 questionnaires are collected for each observable variable.

However, other studies have suggested that using a CFA measurement model with a minimum of 400 individuals and larger sample sizes helps ensure greater CFA results (Bartholomew et al., 2008; Tabachnick & Fidell, 2013). We then selected a sample size of 20 times the number of observed variables and set the optimal number for the sample at 440.

However, as suggested due to sample bias errors, questionnaire completion and audit complexities involved due to the COVID-19 pandemic lockdowns, and to make the empirical data more reliable, the sample size target was increased by 50% (220 people), making the sample target 660 BCP students (Table 2). Thereafter, multistage random sampling was used in the following manner to collect the study's final sample:

1) Stratified random sampling was used to randomly select each of the 21 Rajabhat universities used in the study from one of six geographic Thai regions to select a representative sample from all regions.

2) Simple random sampling was then used in each of the selected regions from a random number generated table method for universities that randomly select universities in each region of not less than 50% of the number of Rajabhat universities that offer courses in that region. If a region had no more than three universities, we selected all universities in that region as the sample group.

3) Simple random sampling was then used by drawing lots of students until the number of students was complete. Details of the number of student sample components classified by region are shown in Table 2.

2.2. Reliability and validity assessment

The primary tool used to measure the variables in the research was a questionnaire on the suitability of the components and indicators of DCS. For analysis purposes, BCP students at each of the 21 Rajabhat universities surveyed were given 10 latent variables and 22 indicators personal opinion assessment questionnaire that used a 5-point Likert-type opinion scale.

Interpretation and criteria values were 4.50–5.00 indicating the '*most agreement*', 3.50–4.49 indicating '*high agreement*', 2.50–3.49 indicating '*moderate agreement*', 1.50–2.49 indicating '*little agreement*' and 1.00–1.49 indicating '*total disagreement*'.

However, before the questionnaire distribution and shortly after its conceptualisation, seven experts in business computer and digital technology studies reviewed each of the questionnaire's items and gave their assessment of the survey instrument's content quality. Numerous studies, such as Chuenban et al. (2021), have suggested that the index of item-objective congruency (IOC) is a useful numerical tool in the experts' assessment process which includes 1) its relevance to the questionnaire's aim, 2) its clarity, 3) its comprehensiveness and completeness and, finally, 4) its significance and meaningfulness for each item.

As such, item values of ≤0.50 are deleted or revised. Therefore, from the IOC process, we were left with a questionnaire whose items had IOC values of 0.57–1.00. Finally, to confirm the questionnaire's usability, accuracy and reliability, we undertook a pre-test in which 30 students were asked to evaluate the proposed questionnaire format and research items. Once again, numerical values were assigned to each group of items using Cronbach's α, in which George and Mallery (2010) have also suggested that ≥ 0.8 is good and α values ≥ 0.9 is excellent, with our pre-test returning α values of 0.81–0.89 (Table 4).

2.3. Data collection and analysis

In our sample collection process, we identified a total of 38 Thai Rajabhat universities for the initial target collection of 660 student questionnaires. Due to the ongoing global COVID-19 pandemic, we used Google Forms to create an online version of our questionnaire.

Therefore, from February 2021 to the end of March 2021, we were happy to find that 506 complete and audited questionnaires were available for analysis (Table 2).

Data analysis was conducted with the use of two statistical software programmes. These were LISREL 9.10, which was used for the analysis of the second-order CFA model's indicators, and IBM's® SPSS® for Windows Version 21 programme for the descriptive statistics output.

Table 2. Population and sample of students classified by regional Rajabhat Universities

Rajabhat Universities by region	**Universities Sampled**	**Population**	Goal	Actual	Percentage
Northern (8 schools)	4	480	63	49	78.12
Central and Metropolitan (8 schools)	4	759	99	77	77.64
Western (4 schools)	2	717	94	74	78.99
Eastern (2 schools)	2	852	111	77	69.16
Northeastern (11 schools)	6	1,640	214	165	77.00
Southern (5 schools)	3	603	79	64	81.23

3. Results/Findings

3.1. Student respondents' general information

In Part 1 of each student's questionnaire was a section concerning their general information, from which we find, in Table 3, that 57.91% of the students were female. Also, 39.72% were in their first year of studies, followed by 24.90% (2nd year), 20.36% (3rd year) and 15.02% (4th year).

Additionally, there was a near-perfect bell curve in grade point average (GPA) with 28.66% stating their GPA was 2.50–2.99 on a scale of 0–4. Finally, the majority of 32.61% indicated they were studying in Thailand's North-eastern region (Isan) schools.

Table 3. Rajabhat University BCP students' general information (*n*=506)

General Information	**Number**	**%**
Gender		
- male	213	42.09
- female	293	57.91
BCP student study year		
- Year 1	201	39.72
- Year 2	126	24.90
- Year 3	103	20.36
- Year 4	76	15.02
Grade point average (GPA)		
- less than 2.00	75	14.82
- 2.00 – 2.49	121	23.91
- 2.50 – 2.99	145	28.66
- 3.00 – 3.49	98	19.37
- 3.50 – 4.00	67	13.24
Which region is your Rajabhat University in?		
- Northern region	49	9.68
- Central and Bangkok metropolitan region	77	15.22
- Western region	74	14.62
- Eastern region	77	15.22
- North-eastern region	165	32.61
- Southern region	64	12.65

3.2. Correlation coefficient (r) testing methods and results

Results from the Pearson product-moment correlation (*r*) construct validity (CV) testing results for the 22 indicators indicated that all the variables in the model were correlated and in the same direction. Moreover, *r* values are often interpreted with three ranges of *r* values indicating a weak (0.10–0.29), moderate (0.30–0.49) or strong (0.50–1) interrelationship (Akoglu, 2018).

Additionally, the Kaiser–Meyer–Olkin (KMO) index analysis was used to determine whether the correlation matrix of the indicators has a unique matrix or not, which therefore shows that there are enough correlations between variables for analysing the CV indicators. This was confirmed as the KMO measure of sampling adequacy = 0.881. The correlation coefficient between all observed variables was between 0.12 and 0.79 with statistically significant for all values (KMO = 0.881, df = 231 and sig = 0.00).

Also, when using IBM's® SPSS® for Windows Version 21 programme, it is possible to conduct Bartlett's test of sphericity which concluded that the approximate χ^2 was 5056.39 and statistically significant at <0.05, meaning that the data in this section has a relationship between the variables and has a very good level of suitability, which is in accordance with the preliminary agreement to carry out further component analysis (Hair et al., 2020).

3.3. The second-order CFA goodness-of-fit (GoF) analysis

Numerous studies use a GoF analysis to assess the second-order CFA model's validity. Therefore, nine additional validity indices plus the values were used for this purpose and were all found to be consistent with the empirical data and thus appropriate for the study's final model analysis, as shown in Figure 1.

The GoF testing result value for χ^2 was not statistically significant (p = 0.11), for χ^2/df = 1.17, root mean square of approximation (RMSEA) = 0.018, goodness-of-fit index (GFI) = 0.97, adjusted goodness-of-fit index (AGFI) = 0.95, normed fit index (NFI) = 0.99, comparative fit index (CFI) = 0.99, root mean square residual (RMR) = 0.03, and standardized root mean square residual (SRMR) = 0.027.

3.4. Mean, S.D., element weights, and R2 values

Table 4 details the mean, SD, the observed variables weights and R^2 values for each of the BCP student's digital citizenship skills. In columns one and two (C1 and C2), the descriptive statistics results from the use of IBM's® SPSS® for Windows Version 21 programme is shown. From the results, we note that the BCP students perceived that *taking responsibility for personal behaviour and actions which comply with digital regulations* (G1) ($\bar{x}$ = 4.48, SD = 0.50) was the most essential aspect in their DCS toolbox.

This was followed closely by *protecting their private information published on digital platforms from digital devices* (F1) ($\bar{x}$ = 4.44, SD = 0.50). However, the BCP students judged their *collaboration abilities in communicating and exchanging information between themselves and other Internet users* as the least crucial aspect (A2) ($\bar{x}$ = 4.25, SD = 0.44).

Also, the analysis showed that each Rajabhat university's BCP students had a 'high agreement' level ($\bar{x}$ = 3.50–4.49) with each of the study's indicators concerning their digital citizenship skills.

Table 4. Mean, SD, element weights and R^2 values of student DCS

Indicator	Rajabhat university BCP undergraduate students' digital citizenship skills	$\bar{x}$ C1	SD C2	(α) C3	β(SE) C4	(t) C5	(R^2) C6
Collaboration	Communication and exchange of information in a digital world.	**4.07**	**0.37**	**0.89**	**0.70 (0.08)**	**9.24****	**0.49**
A1	Appropriate Internet use time.	4.29	0.45		0.59	-	0.35
A2	The communication and exchange of information between Internet users.	4.25	0.44		0.55(0.07)	7.22**	0.30
Literacy	Knowledge concerning the transfer and use of digital/Internet technology.	**4.36**	**0.40**	**0.81**	**0.83 (0.06)**	**12.89****	**0.69**
B1	Knowledge concerning digital tools to access the Internet.	4.39	0.49		0.70	-	0.48
B2	Knowledge concerning Internet network troubleshooting skills.	4.33	0.47		0.64 (0.06)	10.34**	0.41
Thinking	Critical thinking and good judgment.	**4.31**	**0.40**	**0.81**	**0.65 (0.06)**	**10.80****	**0.43**
C1	Data analysis skills.	4.32	0.47		0.77	-	0.60
C2	Using cause-and-effect logic.	4.31	0.46		0.61 0.07)	8.50**	0.38
Access	Equality of rights to access the Internet.	**4.39**	**0.39**	**0.88**	**0.88 (0.05)**	**16.19****	**0.77**
D1	Internet access is safe and open to use.	4.39	0.49		0.78	-	0.61
D2	Knowledge of the standards and requirements for communication systems use.	4.43	0.50		0.71 (0.04)	14.70**	0.51
D3	Digital divide	4.34	0.48		0.66 (0.04)	13.76**	0.43
Security	Identification of potential security problems and privacy protection procedures.	**4.42**	**0.42**	**0.81**	**0.84 (0.08)**	**10.95****	**0.71**
E1	Protecting your security in accessing different websites	4.41	0.49		0.60	-	0.53
E2	Awareness of individual privacy issues.	4.43	0.50		0.73 (0.07)	10.41**	0.55
Footprint	Protecting your digital footprint and reputation.	**4.38**	**0.38**	**0.88**	**1.00 (0.56)**	**17.97****	**1.00**
F1	Protecting your private information published on digital platforms from digital devices.	4.44	0.50		0.71	-	0.51
F2	Concern for your reputation in the digital world.	4.31	0.46		0.46 (0.05)	8.879**	0.21
Law	Understanding of digital laws concerning legal rights and restrictions and technology use.	**4.41**	**0.40**	**0.89**	**0.97 (0.06)**	**15.20****	**0.95**
G1	Taking responsibility for personal behaviour and actions which comply with digital regulations.	4.48	0.50		0.67	-	0.45
G2	Non-infringement of the rights of	4.40	0.49		0.61 (0.05)	11.79**	0.38

Indicator	Rajabhat university BCP undergraduate students' digital citizenship skills	$\bar{x}$ C1	SD C2	(α) C3	β(SE) C4	(t) C5	(R^2) C6
	others.						
G3	Self-awareness against digital crimes.	4.35	0.48		0.61 (0.04)	12.85**	0.38
Etiquette	Manners and ethics in digital device use.	**4.39**	**0.43**	**0.89**	**0.80 (0.06)**	**14.50****	**0.63**
H1	Awareness of the rules, regulations and social etiquette in the digital world.	4.37	0.48		0.77	-	0.59
H2	Recognising the importance of good manners and ethics for others in the digital world.	4.42	0.49		0.69 (0.06)	11.63**	0.48
Empathy	Compassion, cognition, and emotion for others.	**4.39**	**0.39**	**0.85**	**0.81 (0.10)**	**8.086****	**0.65**
I1	Knowledge of the social, political, economic and cultural concerns on the effects of Internet use.	4.42	0.49		0.47	-	0.22
I2	Compassion and empathy at building good relationships with others in the digital world.	4.38	0.49		0.56 (0.08)	6.961**	0.32
Cyberbullying	Cyberbullying in the digital world	**4.41**	**0.39**	**0.81**	**1.00 (0.09)**	**10.67****	**1.00**
J1	Understanding cyberbullying behaviour.	4.40	0.49		0.47	-	0.22
J2	Protecting oneself physically and mentally from cyberbullying.	4.43	0.50		0.57 (0.06)	9.054**	0.33

**$p \leq .01$, *$p \leq .05$

Furthermore, in C3 in Table 4 are the Cronbach α values from the 30 students' pre-tests. A frequently cited α value is ≥ 0.70 which is used to assure reliability. In Table 4, we note that the α value for each of the latent variables was from 0.81 to 0.89, indicating an acceptable to a high level of item reliability.

In C4, we can also find the results from the LISREL 9.10 testing for the β (standardised regression coefficient) which are used for strength comparison effects of each independent variable to the dependent variable (Khaled et al., 2019). Moreover, the theory suggests that the higher the absolute value of β becomes, the stronger the effect. This is consistent with research on Chinese entrepreneurial education by Mu et al. (2020), who stated that a quantitative analysis frequently uses linear regression analysis to accomplish the data analysis in which β can be used to characterise the correlation between the variables.

Moreover, in C4 in Table 4, we find another indicator of the mean value's reliability from the use of the value of SE (standard error). Value interpretation suggests that smaller SEs indicate that the sample mean is a more accurate reflection of the actual population mean.

Larger sample sizes will usually result in a smaller SE, with SD normally not directly affected by a sample's size. In C5 in Table 4, we find that the *t*-test values, which Hair et al. (2020) have suggested, are significant if the absolute *t*-value is $|t| \geq 1.96$.

Once again, model strength determination was made as the lowest *t*-value of 7.22** for A2. Finally, it has been suggested that the coefficient of determination (R^2) testing can be a powerful tool when used in regression analysis evaluations (Chicco et al., 2021).

Therefore, in C6, we find that R^2 values ranged from a low of 0.21 to a high of 0.97. Also, Hair et al. (2020) have stated that R^2 values are used to determine a model's accuracy, and that interpretation for substantial is ≥ 0.75, moderate strength is ≥ 0.50 and weakness is ≥ 0.20, which is the evaluation in human behaviour and their opinions are quite normal and acceptable for wide ranges.

Therefore, from the results shown in Figure 3 and data results in Table 4, we can conclude that the second-order CFA model for Thai BCP student DCS was consistent with the empirical data, as the values for χ^2 was not statistically significant (p = 0.11, χ^2/df = 1.17, RMSEA = 0.018, GFI = 0.97, AGFI = 0.95, NFI = 0.99, CFI = 0.99, RMR = 0.03 and SRMR = 0.027). Moreover, there were positive β weights between 0.46 and 1.00. There were two components determined by the students to be equally weighted in importance.

These were the *protection of one's digital footprint and reputation* (footprint) (β = 1.00, R^2 = 1.00), and *cyberbullying* (cyberbullying) (β = 1.00, R^2 = 1.00), closely followed by a student's *understanding of digital laws concerning their legal rights and restrictions* (law) (β = 0.97, R^2 = 0.95).

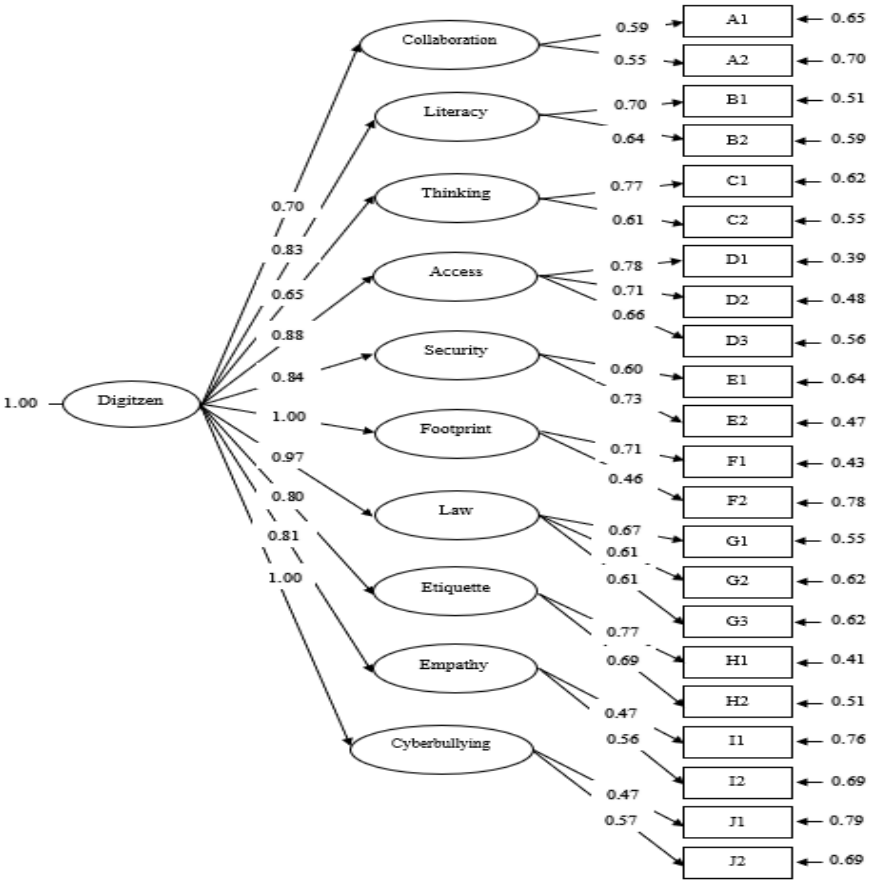

Figure 3. The final model for the second-order CFA of Thai BCP students' digital citizenship skills
Chi-Square = 124.27, df = 106, *p*-value = 0.10857, RMSEA = 0.018

Furthermore, in C3 in Table 4 are the Cronbach α values from the 30 students' pre-tests. A frequently cited α value is ≥ 0.70 which is used to assure reliability. In Table 4, we note that the α value for each of the latent variables was from 0.81 to 0.89, indicating an acceptable to a high level of item reliability.

In C4, we can also find the results from the LISREL 9.10 testing for the β (standardised regression coefficient) which are used for strength comparison effects of each independent variable to the dependent variable (Khaled et al., 2019). Moreover, the theory suggests that the higher the absolute value of β becomes, the stronger the effect. This is consistent with research on Chinese entrepreneurial education by Mu et al. (2020), who stated that a quantitative analysis frequently uses linear regression analysis to accomplish the data analysis in which β can be used to characterise the correlation between the variables.

Moreover, in C4 in Table 4, we find another indicator of the mean value's reliability from the use of the value of SE (standard error). Value interpretation suggests that smaller SEs indicate that the sample mean is a more accurate reflection of the actual population mean.

Larger sample sizes will usually result in a smaller SE, with SD normally not directly affected by a sample's size. In C5 in Table 4, we find that the *t*-test values, which Hair et al. (2020) have suggested, are significant if the absolute *t*-value is $|t| \geq 1.96$.

Once again, model strength determination was made as the lowest *t*-value of 7.22** for A2. Finally, it has been suggested that the coefficient of determination (R^2) testing can be a powerful tool when used in regression analysis evaluations (Chicco et al., 2021).

Therefore, in C6, we find that R^2 values ranged from a low of 0.21 to a high of 0.97. Also, Hair et al. (2020) have stated that R^2 values are used to determine a model's accuracy, and that interpretation for substantial is ≥ 0.75, moderate strength is ≥ 0.50 and weakness is ≥ 0.20, which is the evaluation in human behaviour and their opinions are quite normal and acceptable for wide ranges.

Therefore, from the results shown in Figure 3 and data results in Table 4, we can conclude that the second-order CFA model for Thai BCP student DCS was consistent with the empirical data, as the values for χ^2 was not statistically significant (p = 0.11, χ^2/df = 1.17, RMSEA = 0.018, GFI = 0.97, AGFI = 0.95, NFI = 0.99, CFI = 0.99, RMR = 0.03 and SRMR = 0.027). Moreover, there were positive β weights between 0.46 and 1.00. There were two components determined by the students to be equally weighted in importance.

These were the *protection of one's digital footprint and reputation* (footprint) (β = 1.00, R^2 = 1.00), and *cyberbullying* (cyberbullying) (β = 1.00, R^2 = 1.00), closely followed by a student's *understanding of digital laws concerning their legal rights and restrictions* (law) (β = 0.97, R^2 = 0.95).

4. Conclusion

From the study's initial qualitative analysis, 10 primary and 22 indicators concerning DCS education were identified and subsequently used in a questionnaire on a sample of 506 Thai BCP undergraduate students attending one of six regional Thai Rajabhat universities. GoF and descriptive statistical analysis (mean, standard deviation, KMO index analysis and Bartlett's test of sphericity) were analysed from the use of IBM's® SPSS® for Windows Version 21, while the second-order CFA was carried out using LISREL 9.10.

The results revealed that each student's opinion on their DCS education had a 'high agreement' level. Moreover, importance ranking from high to low of the 10 primary indicators was each student's footprint (1.00), cyberbullying (1.00), law (0.97), access (0.88), security (0.84), literacy (0.83), empathy (0.81), etiquette (0.80), collaboration (0.70) and thinking (0.65). Therefore, it is suggested that this study's results be used to assist various agencies and ministries in building teaching and learning programmes for student digital citizenship skills education.

5. Recommendations

As the COVID-19 pandemic continues to ravage the world, student Internet and digital knowledge have become even more essential due to the ongoing necessity for online education. Thus, it has become imperative that educators and institutions quickly and effectively develop courses for teachers on how to teach digital citizenship and digital literacy skills. Logically, after core groups of educators have been trained how to teach DCS and DL skills, there must be backing from educational ministries down to the smallest rural school administrator. Technological issues such as bandwidth costs, Internet connectivity and reliability need to be also examined. Bleeding edge technologies offered by companies, such as SpaceX, where satellite Internet (Starlink) is affordable, useful and reliable also need to be investigated. Finally, Thai youth today are spending more than 12 hours a day connected to the Internet through digital devices, such as smartphones. Therefore, both parents and their teachers cannot assume they have appropriate Internet use skills.

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