

A Needs Assessment and Confirmatory Factor Analysis of the ACRL Framework for Enhancing Information Literacy Skills Among Undergraduate Students in Thai Higher Education in the Digital Era

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Abstract

Information literacy (IL) in the digital era has evolved beyond basic search strategies to encompass more complex conceptual frameworks. The purposes of this mixed-methods study were 1) to determine the priority IL competencies that digital-era learners perceived as needing improvement, and 2) to test the structural validity of the Association of College and Research Libraries (ACRL) Framework within the Thai higher education context. In the quantitative phase, a sample of 436 undergraduate students from Thai public and private universities completed an online survey. Participants were recruited using stratified random sampling across five geographic regions of Thailand (Northern, Central, Eastern, Northeastern, and Southern). The reliability and validity of the 32-item, five-point Likert-scale questionnaire were rigorously evaluated to demonstrate strong internal consistency (Cronbach's Alpha) and construct validity confirmed through Confirmatory Factor Analysis. In addition to the quantitative component of the study, the qualitative aspect was included in semi-structured interviews where there were 15 experts participating. The data were analyzed using the Modified Priority Needs Index (PNI_{modified}) and Confirmatory Factor Analysis (CFA). The results showed that while students felt that they needed to improve many of their IL competencies, particularly developing a conceptual framework (PNI_{modified} = .320), applying search strategies effectively (PNI_{modified} = .289), those skills were used relatively infrequently. Insights gained from the qualitative component of this study revealed several key reasons why that disparity existed. Today's students have difficulty with ethics-related aspects of information literacy, rely heavily on Generative AI tools, and do not possess the physical stamina to engage in extended periods of critical thinking and analysis. While those difficulties are concerned with learners' behaviors, the CFA supported the structural validity of the theoretical model proposed by the ACRL Framework, providing evidence that supports the notion that the ACRL Framework represents a good fit for empirically based data regarding IL ($\chi^2/df = 2.99$, RMSEA = .06, SRMR = .03, CFI = .95). These findings offer practical guidance for universities to redesign information literacy curricula targeting specific behavioral gaps identified in the digital era, particularly in developing research frameworks and applying effective search strategies.

Keywords: ACRL Framework, information literacy skill, undergraduate students, Thai higher education, digital era

Introduction

The role of information literacy (IL) has evolved from being an essential competency for navigating today's digital era. A student who is truly literate in using information will be able to identify their needs clearly, evaluate the credibility of the resources they are finding, and then use those resources to inform their decision-making process ACRL sees in a responsible manner. Education regarding the process of achieving true IL has been transformed significantly over the past few decades. Rather than viewing IL as merely a checklist of search strategies. The focus of education on IL has evolved to emphasize the ways in which individuals collaboratively construct knowledge and the position learners as active participants in the creation and development of knowledge, rather than passive consumers. (American Library Association, 2000; Hsieh et al., 2021; Jarson & Hamelers, 2022). Despite the rapid evolution of information literacy standards, significant challenges remain in bridging the gap between theoretical knowledge and practical application among digital-era learners. While digital IL is evolving globally, the development of locally validated measurement

tools aligned with the ACRL Framework remains notably limited in the Thai context. Therefore, this study employs an explanatory sequential mixed-methods design. Confirmatory factor analysis (CFA) is utilized to strictly validate these measurement tools, while qualitative expert insights are integrated to contextualize the unique needs of Thai undergraduate students.

Current research highlights a paradigmatic shift from an emphasis on identifying search strategies. In the context of the current digitally oriented world, understanding the difference between resources that are authentic and those which are not is significantly more important than finding resources (Rose-Wiles, 2024; Vong, 2021). As a result, many higher education institutions have begun using the ACRL Framework to provide a foundation for transformative learning experiences (Eva et al., 2021).

However, as previously discussed, one of the major limitations that currently prevent many educators from implementing the ACRL framework across their classrooms remains. Specifically, there still exists a significant barrier that prevents many educators from creating assessments that would appropriately evaluate whether their students

have gained the abstract "Threshold Concepts" outlined by the ACRL Framework (Jarson & Hamelers, 2022; Lawson & Benallack, 2022). The rapidly changing nature of the web makes it even more difficult for educators to develop assessments to measure student achievement of these abstract "threshold concepts." In the digital era, the rapid proliferation of digital media and generative AI means that students must navigate increasingly complex information landscapes, which necessitates advanced information literacy competencies to evaluate sources critically (Ko & Chiu, 2024; Rose-Wiles, 2024). Further complicating the ability for educators to create effective assessments to evaluate student achievement of the "threshold concepts," is the emergence of Generative Artificial Intelligence. This evolving area of technology fundamentally changes how we view "Information Creation as a Process". Instead of simply evaluating the statements made in a text, learners must now evaluate how the AI may have created the content. As a result, learners are being asked to assume more digital responsibility (Ko & Chiu, 2024).

While in the Thai context, despite ongoing efforts to promote information literacy in higher education, a critical gap persists in the availability of contextually grounded and empirically validated measurement instrument aligned with the Association of College and Research Libraries Framework. This limitation is particularly significant given the diversity of institutional contexts and learning environments, which require assessment tools that accurately reflect students' competencies in navigating complex digital information ecosystems. Existing practices often rely on self-reported or descriptive measures, with limited application of rigorous statistical validation techniques. Consequently, the lack of validated, context-specific instruments contains both evaluation of information literacy outcome and the development of effective instructional strategies in the Thai higher education system. Specifically, while educators are utilizing various statistical methods to develop valid measures of IL competency structures, the use of confirmatory factor analysis (CFA) to statistically validate the development of measurement tools is limited. To address this problem, this study employs an explanatory sequential mixed-methods design. Confirmatory Factor Analysis (CFA) is utilized to rigorously test the construct validity and structural relationships of information literacy competencies, while qualitative expert insights are incorporated to contextualize the model within the Thai educational setting. The focus on undergraduate students reflects their critical role as primary users of academic information systems and as a key target group for information literacy development. By integrating quantitative validation with qualitative contextualization, this study aims to produce a reliable and context-sensitive measurement model that can inform curriculum design, instructional practices,

and future information literacy assessment framework in Thailand. (DiNardo et al., 2026).

■ Objectives

1. To assess the actual needs and current experiences of digital-era learners regarding their information literacy competencies.
2. To validate the underlying factors of information literacy competencies among these learners using confirmatory factor analysis.

■ Literature Review

Information Literacy Standards

IL refers to the capacity of individuals to recognize when information is needed, and to locate, evaluate, and effectively use that information. This competency has become foundational in higher education, as it equips students to engage critically with an increasingly complex information landscape. The significance of IL extends beyond academic success—it is a cornerstone of lifelong learning, informed citizenship, and ethical engagement with digital content (American Library Association, 2000; Rose-Wiles, 2024). Despite the rapid evolution of information literacy standards, significant challenges remain in bridging the gap between theoretical knowledge and practical application among digital-era learners.

In 2000, the ACRL provided a significant contribution to the area of Information Literacy when it developed formal standards for information literacy. The intent of the ACRL was to provide assurance that academic institutions would graduate students that were truly "information literate" (American Library Association, 2000; Rose-Wiles, 2024; Ko & Chiu, 2024; Lawson & Benallack, 2022). In order to assure that students had the skills necessary to become an information literate, the ACRL developed five basic standards. An information literate student will have demonstrated the ability to meet the following requirements: 1) Determine the information needed: Determine the specific nature and extent of the information needed to resolve an issue. 2) Access the information: Locate and obtain the appropriate sources quickly and efficiently. 3) Evaluate the information: Assess the credibility of the information and incorporate the most useful information into their existing knowledge base. 4) Apply the information: Utilize the gathered information in a manner that accomplishes specific objectives, either individually or collaboratively with others. 5) Utilize the information ethically: Understand the broader legal, economic and social implications of utilizing information, and utilize the information in a manner that respects the rights of others, including those related to the use of intellectual property and ethical boundaries. Building upon these recent theoretical advancements, the following methodology outlines the empirical approach used to

assess and validate these IL competencies within the target population.

The ACRL Framework for Information Literacy

In 2016, the Association of College and Research Libraries (ACRL), released the Framework for Information Literacy for Higher Education, which created a significant paradigmatic shift in higher education. This shift was so much more than simply changing the terms. The ACRL Framework increased information literacy beyond a mechanical set of skills into an advanced conceptual understanding that promotes more complex learning processes. The six interconnected core concepts are used as a flexible compass to guide skill development (Rose-Wiles, 2024; Ko & Chiu, 2024).

1) Authority is constructed and contextual: To develop critical thinking skills, learners must learn to evaluate where their content comes from, the true area of expertise of the person who created the content, and why they published the content. The credibility of a source may vary based on the learner's specific requirements, their viewpoint, and the context of the content.

2) Information creation as a process: Each piece of information undergoes its own unique production process that demonstrates how the content was produced and for whom it was intended. Understanding this supports learners in recognizing how format and method of communication affect their perception and interpretation of the underlying message.

3) Information has value: Information serves as a commodity with both monetary and intellectual value. Learners must recognize and respect the rights of content producers, identify the various levels of open access available, and most importantly honor the original authors of the content through proper citation practices.

4) Research as inquiry: Real research is more than simply searching for quick answers that fit into pre-determined categories. Rather, research is a long-term journey of discovery that is motivated by thought-provoking questions, extensive investigation, and a desire to consider multiple perspectives or viewpoints.

5) Scholarship as conversation: The academic world is essentially one large-scale, ongoing discussion. In this environment, students are encouraged to join in on the conversation rather than merely read, absorb, and passively accept information. As such, students can provide their own thoughts or reactions to what they have learned; question others' conclusions based upon previously researched ideas; and utilize references in order to add their knowledge to existing literature.

6) Searching as strategic exploration: Due to the vastness and constant flux of the information environment, learners are unlikely to find their required information using a rigid search strategy. Typically, an initial search is merely a first step. Learners continually adjust

their search strategies and ask themselves what parameters they require for their search, what format would serve them best, and what type of organization would be the ideal source.

Ultimately, the ACRL Framework serves as a philosophical guide rather than a rigid instruction manual, completely transforming how students interact with data. Thanks to its flexibility, educators can weave these concepts into curriculum design, classroom instruction, and library services (Lawson & Benallack, 2022; Schmidt et al., 2025; Condon & Pothier, 2022). The Framework is also applied to social problems including equity in education and spread of misinformation (DeStasio, 2025; Baydoun & Brillat, 2023; Faix & Fyn, 2023). As Generative AI grows rapidly, students must critically evaluate AI-generated content (Ko & Chiu, 2024).

Distinguishing Between Information Literacy Standards and the Framework

The advancement of IL within higher education exemplifies one of the most significant paradigm shifts in the discipline—progressing from quantifiable behavioral skills (ACRL 2000 Competency Standards) to conceptualization, application, and ethical utilization of information (ACRL Framework; American Library Association, 2016).

While the original ACRL Standards provided practical step-by-step processes for teaching IL, they offered limited room for creativity in designing educational activities or assessments. The literature highlights that viewing IL solely as a list of skills limits student engagement to mere mechanical compliance and restricts opportunities for deeper understanding of social and political power structures that shape knowledge construction (Hsieh et al., 2021).

To address this limitation, the ACRL Framework introduced 'Threshold Concepts'—transformative ideas that require students to acknowledge that knowledge is socially constructed. Examples include 'Authority is Constructed and Contextual' and 'Scholarship as Conversation.' According to Eva et al. (2021), many students report a significant transformation in their thinking about IL after gaining an understanding of these threshold concepts (Jarson & Hamelers, 2022).

With its flexible design, the Framework can be incorporated into numerous subjects (Condon & Pothier, 2022; Kim et al., 2023; Schmidt et al., 2025). While the Standards and the Framework are designed for different purposes, they are compatible: the standards establish an operational baseline of what university students should know, while the Framework defines a complete conceptual model for using those skills across educational settings.

Critically, despite widespread adoption of the ACRL Framework globally, a significant gap exists in Thailand regarding the systematic, empirically validated assessment of students' digital IL competencies. While researchers

internationally have employed CFA to validate IL measurement instruments (e.g., Hsieh et al., 2021; DiNardo et al., 2026), such validation studies remain scarce in the Thai higher education context. This study directly addresses this gap by validating the ACRL Framework's factor structure among Thai undergraduate students, thereby contributing to the development of culturally appropriate IL assessment tools.

Methodology

This study employed an explanatory sequential mixed-methods design. The quantitative survey assessed learners' perceived needs, while subsequent qualitative interviews with 15 experts were utilized to complement the statistical data, explaining the underlying factors behind the disparities between perceived needs and actual behaviors. The quantitative methodology used the data from 436 higher education student participants who

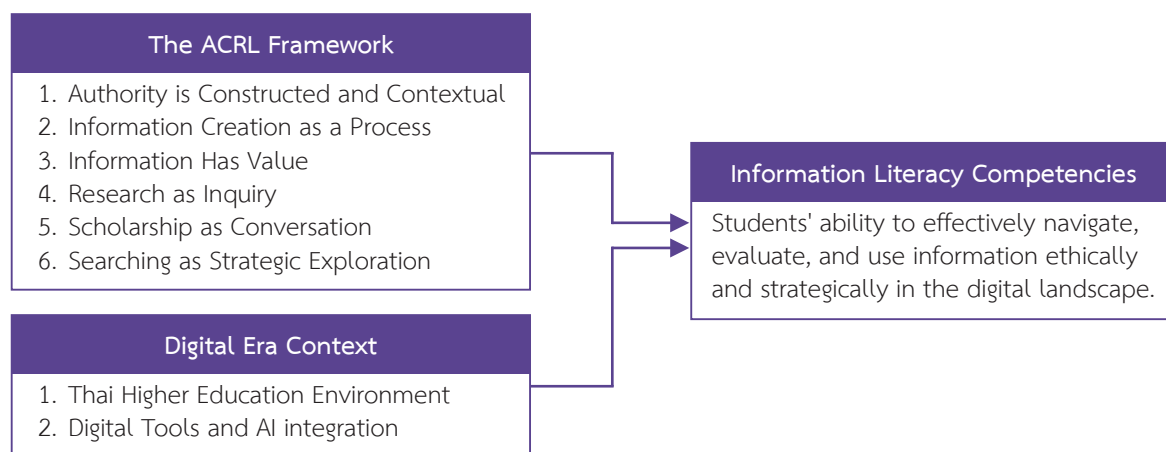
responded to an online survey. Descriptive statistics were utilized to provide a description of the characteristics of the data. Confirmatory factor analysis (CFA) was also performed to evaluate whether the hypothesized measurement model fit the observed data. The qualitative methodology consisted of conducting in-depth interviews with 15 expert panelists who have experience in information literacy and users of information to assess the relevance and appropriateness of the ACRL Framework (2016) for Thai students.

Research Framework

The conceptual framework positions the six dimensions of the ACRL Framework as independent constructs. The dependent variable, information literacy competencies, is measured in terms of mean scores on the 32-item survey instrument, representing students' ability to effectively navigate, evaluate, and use information ethically and strategically in the digital landscape.

Figure 1

Research Conceptual Framework



Population and Sample

The population was defined as individual undergraduate students in Thailand. To account for potential nonresponse or incomplete data, a larger pool was targeted. The final sample consisted of 436 participants distributed equally across the Northern, Central, Eastern, Northeastern, and Southern regions using stratified random sampling. Following standard confirmatory factor analysis (CFA) guidelines, a minimum of 5 to 10 participants per estimated parameter is required (Hair et al., 2012). Because the proposed model contained 30 parameters and 5 observed variables, the required sample size was 300. The collected sample of 436 participants sufficiently exceeded this threshold.

Research Instruments Development

The first questionnaire items for the instrument were developed from an extensive literature review. To ensure the items fit within the study's conceptual framework,

an initial review was done by the thesis advisor. A panel of five subject-matter experts in information literacy and ICT reviewed the draft. We used the index of item-objective congruence (IOC) to validate content, which we did strictly as items had to score an acceptable .50 or higher. After the panel provided their positive feedback, we piloted the instrument using a preliminary group of thirty students to verify internal reliability using Cronbach's Alpha Coefficient.

Data Collection

Data were collected using digital tools and platforms, including an online questionnaire and virtual in-depth interviews. A total of 436 undergraduate students from public university in Thailand participated in the survey. Participants were selected using stratified random sampling based on the following inclusion criteria: 1) currently enrolled as undergraduate students, 2) having experience in using digital information resources, and 3) willingness to participate voluntarily in the study. The sample size was

considered adequate for CFA, as it exceeded the recommended minimum of 300 participants and met the criterion of at least 5-10 respondents per estimated parameter (Hair et al., 2019; Kline, 2016). Additionally, 15 expert participants were invited for virtual interviews to provide deeper insights. All data collection was conducted in accordance with established ethic standard. The survey was distributed through official institutional channels, and participants provide informed consent prior to participation. Additionally, all research instruments and protocols were developed and implemented in compliance with research guidelines and were reviewed and approved by the Human Research Ethics Committee at Chulalongkorn University (Approval No. 326/67; COA No. 326/67).

Data Analysis

Data analysis was conducted in two stages. First, descriptive statistic, including frequency, percentage, mean and standard deviation, were analyzed using SPSS to describe participant's characteristics and information literacy levels. Additionally, the priority needs index (PNI) was calculated to examine the gaps between current and expected conditions, addressing the first research objective. Second, CFA and structural equation modeling (SEM) to validate the measurement model and examine relationship among variables. The model fit was evaluated using the following established criteria: $X^2/df < 3.0$, root mean square error of approximation (RMSEA) < 0.08 , standardized root mean square residual (SRMR) < 0.08 , and comparative fit index (CFI) > 0.90 . (Hair et al., 2019; Hu & Bentler, 1999; Kline, 2016). Finally, qualitative data from interviews were analyzed using content analysis. The findings were systematically interpreted in relation to the research objectives and the ACRL Framework to support the development of the proposed model.

These advanced analytical techniques were essential to verify that the measurement model met the required levels of validity and reliability, and also to model the relationships between the variables that we had identified. Finally, on the qualitative side, the transcripts of the user interviews and expert interviews were subject to content analysis. We consistently correlated the results of the participant's comments with the original research questions and the ACRL Framework to continuously develop the various components of the systematic approach.

■ Results

Part 1 Demographic Profile and Baseline Characteristics

The survey collected data from 436 students pursuing an undergraduate degree. The demographic information

is mainly composed of females (65.60%, $n = 286$) with males (31.88%, $n = 139$) and a few participants who did not provide their gender (2.52%, $n = 11$). In terms of academic status, second year students made up the largest number of participants (40.14%), followed by third year students (23.85%), fourth year students (19.04%), and finally first year students (16.97%).

Considering how students access and use technology for information literacy, the most common method is through portable electronic devices. Specifically, nearly 91% of all students use smartphones as their primary source for digital learning. Approximately 70% of students use tablets and approximately 64% of students use laptops. Desktop computers are used by just under 30% of the sample. It is interesting to note that the high use of mobile technology is consistent with the fact that almost the entire sample has extensive exposure to digital technology. Approximately 42% of students report having spent 5-10 years using the Internet, while another 38% reported spending over 10 years using the Internet. Less than 20% of students reported spending less than 5 years using the Internet.

Students were asked about their level of expertise in certain areas, including searching and accessing content via various digital platforms. Students showed a higher level of expertise in using social media (Facebook, Line, YouTube, and Instagram) compared to other areas (83.94%). In addition, students displayed a high level of expertise when using formal online learning platforms (77.75%), and basic search engines such as Google (77.06%). Conversely, students showed lower levels of expertise when it came to emerging technologies such as the metaverse (30.96%). Therefore, it appears that the metaverse will continue to be an emerging area of technology in education for some time to come.

Respondents provided their opinions on what characteristics make up the modern digital learner. There was a significant percentage (82%) of students who felt that being able to effectively use digital tools for both school and work was one of the defining characteristics of a modern digital learner. Similarly, there was a high percentage of students (80%) who believed that a modern digital learner should have a general awareness and understanding of digital concepts. However, there was a large difference in the percent of students who felt that a modern digital learner should have advanced thinking capabilities (i.e., complex information processing abilities). Only slightly more than two-thirds (64.9%) of the students surveyed felt this way.

Table 1
Demographic Profile and Baseline Characteristics

(n = 436)

Variables	Categories	n	%
Gender	Male	139	31.88
	Female	286	65.60
	Unspecified	11	2.52
Education level	First year	74	16.97
	Second year	175	40.14
	Third year	104	23.85
	Fourth year	83	19.04
Regions	Northern	87	19.95
	Central	88	20.18
	Eastern	87	19.95
	Northeastern	87	19.95
	Southern	87	19.95
Device for Supporting Information Literacy	Notebook	279	63.99
	Desktop computer	129	29.59
	Smartphone	396	90.83
	Tablet	306	70.18
Internet experience	Less than 5 years	86	19.72
	5–10 years	186	42.66
	More than 10 years	164	37.62
Application skills	Social media	366	83.94
	Search engine	336	77.06
	Video Steaming	288	66.06
	Digital Learning Platform	339	77.75
	Chatbot	297	68.12
	Metaverse	135	30.96
	Website	158	36.24
	Other application	1	0.23
Online Learning Tools Enhancing for Information Literacy	Social media	271	62.16
	Search engine	299	68.58
	Video Steaming	230	52.75
	Digital Learning Platform	296	67.89
	Chatbot	252	57.80
	Metaverse	137	31.42
	Social media	167	38.30

Table 1
(continued)

Variables	Categories	n	%
Characteristics of a learner in the digital age	Ability to use digital tools for learning and work	357	81.88
	Digital literacy and understanding of information cognition & processing	347	79.59
	Information processing skills	283	64.91
	Creative thinking skills	290	66.51
	Ability to access digital technology and network for learning	317	72.71

Part 2 Experience and Engagement with Library Services

The survey results indicate that nearly one-half of the surveyed population (49.77%) use a combination of physical and digital services. The remaining half are divided into two categories. The first category includes those who exclusively utilize the physical library (onsite) which accounts for approximately 34.17% of users. The second category consists of those who exclusively utilize the digital library (online) which accounts for a minority of users (16.06%). These numbers suggest that there remains value in using physical libraries as part of a hybrid or blended model.

In addition, the data demonstrate that library usage occurs sporadically and does not follow a habitual or routine-based pattern. More than two-thirds (67.66%) of students report that they visit the library most often at times of high academic stress such as exam periods and thesis deadlines. Students who report visiting the library 1-2 times/week account for 31.42% of the total number of students. Students who report attending the library on a daily basis account for 10.32% of the students. Therefore, it appears that many contemporary students view the library as a means to achieve their educational goals rather than as an everyday activity. Students' primary reasons for using the library are based upon a practical

application. As previously stated, students' primary reason for using the library is to complete their course assignments. Over seven-tenths (71.33%) of students use the library for this purpose. In addition, more than six-tenths (60.55%) of students also use the library to explore topics of personal interest. Many students are now using the library as a location for synchronous learning experiences. The library is being used for online lectures by over five and one-half tenths (57.11%) of students. Finally, over five and three-quarters tenths (55.73%) of students use the library's services for conducting research and completing theses, indicating the library's importance for higher education.

Based on the responses from the students regarding how they become literate about finding information, students clearly prefer traditional forms of service delivery. Traditional forms of service delivery include a digital catalog (68.12%) and e-books (56.88%). Both forms of service delivery are well-established and provide direct access to the user. Conversely, new forms of service delivery that have the potential to be more engaging and immersive (i.e., Library Metaverse (25.46%), Virtual Library Tours (22.25%)) had significantly less usage intentions. This difference in usage intention may indicate that even though students possess strong technical skills, they prefer traditional, easy-to-use service delivery systems to complex, immersive technologies that require a greater amount of time to learn.

Table 2
Experience and Engagement with Library Services

(n = 436)

Variables	Categories	n	%
Mode of resource access	On-site	149	34.17
	Online	70	16.06
	Hybrid (On-site and online)	217	49.77

Table 2
(continued)

Variables	Categories	n	%
Frequency and typology of engagement	Daily	45	10.32
	1–2 times per week	137	31.42
	During exams or thesis preparation	295	67.66
	Others	1	0.23
Purpose of library use	Course-related research & assignments	311	71.33
	Research and thesis work	243	55.73
	Update academic developments	178	40.83
	Personal interests	264	60.55
	Use space for online learning	249	57.11
	Other purposes	1	0.23
Library services	Web OPAC	297	68.12
	Author of the month	171	39.22
	E-books	248	56.88
	Reader development corner	137	31.42
	Blog writing	121	27.75
	Virtual Reference Service	149	34.17
	Event alert	129	29.59
	Project mapping	141	32.34
	Enquiry Feedback	129	29.59
	Library Metaverse	111	25.46
	Virtual Library Tour	97	22.25

Part 3 Priority Needs of Information Literacy Competencies among Learners in the Digital Era

The $PNI_{modified}$ analysis indicated differences between the current and expected levels of students' information literacy competencies across the six dimensions of the ACRL Framework. Higher $PNI_{modified}$ scores were observed in items related to higher-order and task-based applications, suggesting that digital era learners perceived greater needs in practical information literacy competencies than in introductory-level concepts.

The largest gap identified in the Authority is constructed and contextual dimension was to be able to distinguish between general and discipline-specific sources on a critical level ($PNI_{modified} = .274$). This was followed closely by being able to determine which sources would best fit the task at hand ($PNI_{modified} = .268$). Most importantly, the least amount of emphasis placed on students was determining

their informational needs ($PNI_{modified} = .220$).

A similar relationship can be seen in the Information creation as a process. The top two PNI values were related to creating effective search strategies ($PNI_{modified} = .289$) and narrowing down the scope of searches ($PNI_{modified} = .271$); conversely, establishing basic search terms represented the least emphasized area of research ($PNI_{modified} = .212$). The implication from this relationship indicates that students have trouble with executing research strategies over developing their initial search ideas.

Students' anxiety regarding the value of information has been reflected in the data collected. Specifically, the top two PNI values in relation to information has value was having practical knowledge regarding how to protect themselves electronically and their electronic rights ($PNI_{modified} = .246$), and having practical knowledge about the legal ways to distribute one's digital work ($PNI_{modified} = .223$).

Notably, having a broad, abstract knowledge of professional information ethics fell at the bottom of this category ($PNI_{\text{modified}} = .190$).

The largest development gap observed throughout the course of the study occurred within the Research as Inquiry dimension. Students indicated that they required significant assistance in developing the research frameworks used when conducting research ($PNI_{\text{modified}} = .320$), the highest overall rating found. Developing data analysis skills, synthesizing data, and interpreting results were found to follow very close behind ($PNI_{\text{modified}} = .274$). In contrast, students had less of a requirement for assistance in identifying problems or developing the initial research question ($PNI_{\text{modified}} = .240$), further illustrating that students require structured support when conducting research

as opposed to help in selecting a topic.

Both Scholarship as Conversation and Searching as Strategic Exploration yielded exactly the same developmental requirements. For each of these areas, the product desired by the learner is content production. Students identified that they required skills necessary to create and present information to specific audiences and through various media formats ($PNI_{\text{modified}} = .278$). The other skills students identified as needing development were those skills which enable them to develop extended learning methods so they may build new knowledge ($PNI_{\text{modified}} = .272$). Furthermore, students identified that integrating new findings into existing knowledge was their lowest need across these two dimensions ($PNI_{\text{modified}} = .217$).

Table 3

Priority Needs of Information Literacy Competencies among Learners in the Digital Era

($n = 436$)

Variables	Desired Condition		Actual Condition		PNI_{modified}	Priority Rank
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
1. Authority is Constructed and Contextual						
1.1 Identify information needs	4.32	0.74	3.54	1.14	0.220	5
1.2 Identify information resources	4.50	0.62	3.57	0.97	0.261	3
1.3 Select relevant sources	4.59	0.63	3.62	1.03	0.268	2
1.4 Integrate prior and new knowledge	4.38	0.73	3.53	1.07	0.241	4
1.5 Differentiate general vs. subject sources	4.37	0.65	3.43	1.14	0.274	1
2. Information Creation as a Process						
2.1 Define keywords and topics	4.28	0.78	3.53	1.18	0.212	4
2.2 Apply search strategies effectively	4.51	0.62	3.50	1.03	0.289	1
2.3 Refine search queries	4.55	0.65	3.58	1.01	0.271	2
2.4 Manage and organize search results	4.37	0.72	3.51	1.12	0.245	3
3. Information Has Value						
3.1 Apply information ethics	4.32	0.77	3.63	1.21	0.190	5
3.2 Understand copyright	4.55	0.65	3.75	1.08	0.213	4
3.3 Ensure information security awareness	4.61	0.64	3.70	1.09	0.246	1
3.4 Understand and avoid plagiarism	4.47	0.69	3.67	1.19	0.218	3
3.5 Use information legally	4.44	0.69	3.63	1.17	0.223	2
4. Research as Inquiry						
4.1 Formulate research problem and questions	4.34	0.74	3.50	1.18	0.240	9
4.2 Review relevant literature	4.48	0.63	3.55	1.03	0.267	3
4.3 Collect preliminary data	4.55	0.65	3.60	1.05	0.264	4
4.4 Develop conceptual framework	4.41	0.70	3.34	1.18	0.320	1

Table 3
(continued)

Variables	Desired Condition		Actual Condition		PNI _{modified}	Priority Rank
	M	SD	M	SD		
4.5 Formulate research hypotheses	4.36	0.67	3.48	1.11	0.253	6
4.6 Design research methodology	4.45	0.67	3.58	0.98	0.243	8
4.7 Analyze and interpret data	4.51	0.70	3.54	1.07	0.274	2
4.8 Write research reports	4.46	0.65	3.57	1.06	0.249	7
5. Scholarship as Conversation						
5.1 Integrate existing and new information	4.27	0.79	3.51	1.18	0.217	5
5.2 Communicate information effectively	4.51	0.63	3.53	1.02	0.278	1
5.3 Select appropriate presentation formats	4.52	0.71	3.62	1.03	0.249	3
5.4 Apply knowledge to create new insights	4.44	0.66	3.49	1.12	0.272	2
5.5 Use appropriate citation styles	4.34	0.76	3.55	1.08	0.223	4
6. Searching as Strategic Exploration						
6.1 Understand information formats	4.25	0.76	3.53	1.18	0.204	3
6.2 Use online databases effectively	4.51	0.63	3.60	0.98	0.253	2
6.3 Evaluate relevance of information	4.54	0.66	3.56	1.07	0.275	1
6.4 Evaluate credibility of sources	4.35	0.68	3.62	1.06	0.202	4

Part 4 Qualitative Analysis of Challenges and Strategic Recommendations for Digital-Era Learners

The qualitative findings were organized into three key themes, each supported by direct evidence from the expert interviews:

1. **Ethical Disconnection and AI Dependency.** Students demonstrate a concerning disconnection from the ethical and proprietary dimensions of information. Many students operate on the assumption that information found digitally is freely available, leading to plagiarism and unattributed use of generative AI. One expert participant observed: "Students often do not realize that copying from an AI-generated text without attribution is a form of academic dishonesty—they see AI as a tool, not as a source that requires citation" (Expert 3, personal communication). This finding is consistent with the quantitative data showing that students place the highest developmental priority on protecting electronic rights (PNI_{modified} = .246) and on understanding copyright (PNI_{modified} = .213).

2. **Deficits in Critical Inquiry Skills.** Instead of using critical thinking to develop analytical research questions, learners increasingly outsource their cognitive tasks to generative AI. Experts have expressed concern that this trend is diminishing learners' critical thinking and synthesis

abilities. As one expert noted: "When I ask students to formulate a research question, they immediately reach for ChatGPT. They have lost confidence in their own ability to think through a problem independently" (Expert 7, personal communication). This directly explains the highest PNI_{modified} score of .320 for developing a conceptual framework.

3. **Over-reliance on Familiar Digital Platforms.** Learners prefer general search engines such as Google and avoid time-consuming processes required to access complex scholarly databases. As a result, learners have been identified as having significant deficiency in evaluating credible sources. Experts confirmed: "Students know how to Google, but they do not know how to conduct a database search using Boolean operators or how to read a database record" (Expert 11, personal communication). This helps explain the high PNI_{modified} score for applying search strategies effectively (.289).

Part 5: Confirmatory Factor Analysis Results

The psychometric analysis of the information literacy competency assessment validates the structural integrity of the 32 items, five-point Likert scale. The measure model is grounded in the ACRL Framework and is defined by the six discrete dimensions: Authority is constructed

and contextual (ACC), information creation as a process (ICP), information has value (IHV), research as inquiry (RAI), scholarship as conversation (SAC), and searching as strategic exploration (SSE). In order to test the construct validity of the assessment, a confirmatory factor analysis (CFA) was completed. The CFA results demonstrated a strong fit to the empirical data ($\chi^2 = 1295.90$, $df = 432$, $p < .01$, $\chi^2/df = 2.99$, RMSEA = .06, SRMR = .03, CFI = .95, NFI = .95), successfully meeting all specified criteria. All

specified criteria were met, confirming excellent model fit (Hair et al., 2012; Kline, 2016).

Overall, these results demonstrate that each of the six theoretical dimensions can be reliably and validly measured through the corresponding observed indicators. These results support the notion that the assessment has sound construct validity and therefore serves as a reliable measure for assessing the competencies of digital-era learners.

Table 4

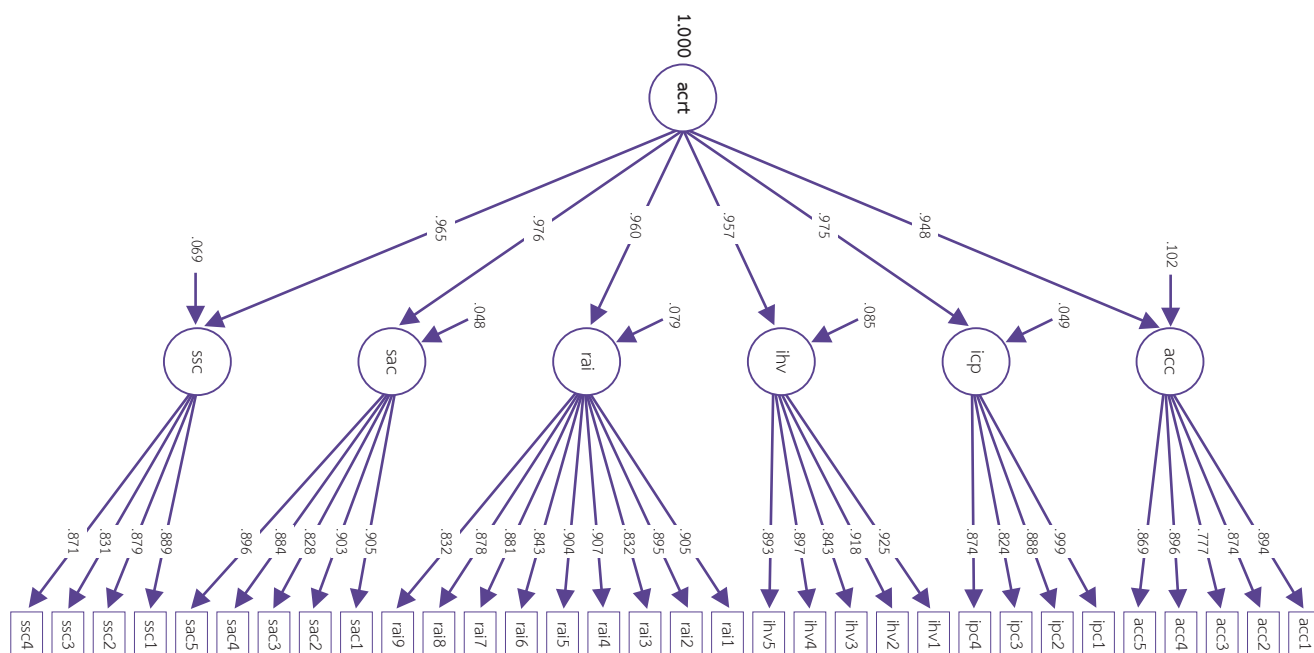
The Confirmatory Factor Analysis of the Measurement of Information Literacy Competencies

Factor Loading						
Item	ACC	ICP	IHV	RAI	SAC	SSE
Item 1	0.89**	0.90**	0.93**	0.91**	0.91**	0.89**
Item 2	0.87**	0.89**	0.92**	0.90**	0.90**	0.88**
Item 3	0.78**	0.82**	0.84**	0.84**	0.83**	0.83**
Item 4	0.90**	0.87**	0.90**	0.91**	0.88**	0.87**
Item 5	0.87**		0.89**	0.90**	0.90**	
Item 6				0.84**		
Item 7				0.88**		
Item 8				0.88**		
Item 9				0.83**		

$\chi^2 = 1295.90$, $df = 432$, $p = 0.00$, $\chi^2/df = 2.99$, RMSEA = 0.06, SRMR = 0.03, CFI = 0.95, NFI = 0.95

Figure 2

Components and Indicators of Information Literacy Competencies among Learners in the Digital Era



To test for how well the measurement model was measuring the constructs, researcher evaluated it with two types of psychometric reliability and validity measures; composite reliability (CR) and average variance extracted (AVE). The requirements to pass both tests were a composite reliability score greater than .70 and an average variance extracted score greater than .50. All six constructs passed this test in exceptional ways. First, all the six constructs had composite reliabilities of .92 and above demonstrating

high levels of internal consistency. Second, as indicated by the AVE all the constructs explained 75 percent or more of the variance associated with each construct. This is clearly higher than the 50 percent threshold set to meet the criteria. Overall, the reliability and validity results show that the observed constructs are very reliable and have good validity in terms of being accurate representations of the digital era information literacy core competencies.

Table 5

Confirmatory Factor Analysis of the Measurement of Information Literacy Competencies among Learners in the Digital Era

Variables	α^a	CR ^b	AVE ^c
Authority is Constructed and Contextual	0.80	0.94	0.75
Information Creation as a Process	0.78	0.93	0.76
Information Has Value	0.85	0.95	0.80
Research as Inquiry	0.91	0.97	0.77
Scholarship as Conversation	0.86	0.95	0.78
Searching as Strategic Exploration	0.81	0.92	0.75

Table 6

Heterotrait-Monotrait Ratio (HTMT) of the Information Literacy Competencies Constructs

	ACC	ICP	IHV	RAI	SAC	SSE
ACC	—	0.974	0.923	0.905	0.913	0.895
ICP		—	0.952	0.946	0.959	0.925
IHV			—	0.913	0.932	0.924
RAI				—	0.950	0.938
SAC					—	0.969
SSE						—

To further examine the discriminant validity among the six first-order constructs, the heterotrait-monotrait (HTMT) ratio of correlations was calculated following the procedure recommended by Henseler et al. (2015). As presented in Table 6, the HTMT values ranged from 0.895 to 0.974, slightly exceeding the commonly recommended threshold of 0.90 for conceptually distinct constructs. Nevertheless, this finding is theoretically justifiable and does not indicate a critical validity concern within the present model specification.

This study adopts a second-order CFA framework, in which six first-order constructs. ACC, ICP, IHV, RAI, SAC, and SSE are conceptualized as interrelated subdimen-

sions of a single higher-order construct, namely digital era information literacy core competencies. In accordance with prior methodological literature, discriminant constructs are theoretically independent (Henseler et al., 2015; Voorhees et al., 2015).

However, in higher-order factor models, strong intercorrelations among first-order constructs are not expected but also theoretically necessary to justify the existence of a higher-order latent construct (Chen et al., 2005; Rindskopf & Rose, 1988). In this study, the comparison between the first-order CFA model and the second-order CFA model yielded a Target Coefficient of $T = X^2_{\text{first-order}} / X^2_{\text{second-order}} = 1240.81 / 1295.90 = 0.957$, indicating that

the second-order model explains approximately 95.7% of the covariance among the first-order constructs (Marsh & Hocevar, 1985). This result provides strong empirical support for the appropriateness of the higher-order structure.

Further evidence supporting the second-order model is demonstrated by several key indicators. First, all second-order factor loadings were high and statistically significant, ranging from 0.948 to 0.976 ($p < .001$), indicating that the higher-order construct explains a substantial proportion of variance in each first-order dimension. Second, the overall model fit indices indicated an excellent fit to the data ($\chi^2/df = 2.99$, CFI = 0.95, SRMR = 0.03, RMSEA = 0.06), consistent with recommended thresholds in structural equation modeling (Hair et al., 2021). Third, convergent validity was strongly supported at the first-order level, with CR values exceeding 0.92 and AVE values exceeding 0.75 across all six constructs.

Therefore, although the HTMT values exceeded the conventional threshold, these elevated values reflect the shared variance captured by the higher-order construct rather than a lack of discriminant validity. The inclusion of HTMT results in Table 6 is intended to ensure methodological transparency and robustness of reporting.

■ Discussion

The results of the priority need assessment illustrate a significant disparity between learner intent and learner action: the findings indicate that learners demonstrate awareness of information literacy concepts; however, there is a distinct disparity between this intent and actual behavior. This is empirically supported by the highest developmental gaps observed in the Modified Priority Needs Index, particularly in developing a conceptual framework ($PNI_{\text{modified}} = .320$) and applying search strategies effectively ($PNI_{\text{modified}} = .289$).

Relating these findings specifically to the ACRL Framework dimensions: The Research as Inquiry dimension showed the greatest developmental gap ($PNI_{\text{modified}} = .320$ for conceptual framework development), reflecting students' difficulty sustaining the iterative, question-driven inquiry process envisioned by the Framework. The Information Creation as a Process dimension ($PNI_{\text{modified}} = .289$ for applying search strategies) indicates that students understand the concept of strategic searching but struggle to execute it—consistent with Jarson and Hamelers' (2022) observation that students often interpret threshold concepts abstractly without translating them into action.

These quantitative gaps are directly explained by the qualitative findings: students' outsourcing of cognitive tasks to generative AI for their underdeveloped research framework skills, while their over-reliance on familiar search engines for deficits in applying strategic search methods. This integration of qualitative and quantitative findings aligns with recent scholarship demonstrating that

engagement with AI tools fundamentally alters students' approach to inquiry-based research (Ko & Chiu, 2024; Rose-Wiles, 2024).

Additionally, the confirmatory factor analysis yielded a well-fitting second-order measurement model ($\chi^2/df = 2.99$, CFI = 0.95, SRMR = 0.03, RMSEA = 0.06), with all six first-order factor loadings on the higher-order construct ranging from 0.948 to 0.976 ($p < .001$). This result carries significant implications for both the theoretical understanding and the practical assessment of information literacy in the digital era. From a theoretical perspective, the validated second-order structure empirically confirms that information literacy should be conceptualized not as a collection of independent, discrete skills but as an integrated, multidimensional competency governed by a common higher-order factor.

The integrity of the measurement model indicates that information literacy is intrinsically connected to higher-order cognitive processes such as critical inquiry; rigorous evaluation of source credibility; and the development of synthesized knowledge from raw data. These quantitative findings were further supported by the qualitative results, which revealed that students often relied on familiar search behaviors and generative AI tools rather than engaging in deeper inquiry-based learning and critical evaluation processes. This integration of qualitative and quantitative findings reinforces the interpretation that information literacy in the digital era extends beyond technical search skills and requires complex cognitive and reflective competencies.

This finding supports the philosophical position embedded in the ACRL Framework (American Library Association, 2000), which frames information literacy as a set of interconnected knowledge practices and dispositions rather than a checklist of standards. The high second-order loadings particularly for scholarship as conversation (0.976), information creation as a process (0.975), and searching as strategic exploration (0.965) suggest that these dimensions are deeply intertwined, and that developing competency in one area is likely to reinforce competency in others. From a practical standpoint, the validated factor structure has direct implications for assessment design and curricular development. First, the strong higher-order structure suggests that holistic assessment approaches such as portfolio-based evaluation or integrated research projects may be more appropriate for measuring information literacy than isolated, skill-specific tests, as the competencies function as an interconnected system rather than separable units. Second, the uniformly high factor loadings indicate that all six dimensions contribute meaningfully to the overall construct, suggesting that curricula should address all six framework areas rather than prioritizing selected dimensions. Third, the measurement model provides a validated instrument that

institutions can adopt or adapt for diagnostic assessment of undergraduate information literacy competencies, enabling the identification of specific areas requiring pedagogical intervention as demonstrated by the PNI analysis in the present study.

In summary, this study demonstrates that the ACRL Framework has strong structural validity within the Thai higher education context and that specific, empirically identified behavioral gaps—particularly in research as inquiry and information creation as a process—represent priority targets for curricular intervention. A key limitation is the reliance on self-reported survey data, which reflects students' perceptions of their abilities rather than direct performance measurement. Future research should employ observational or performance-based assessments to validate these self-reported gaps.

■ Conclusions

The findings of this study demonstrate that digital-era undergraduate students in Thailand possess a foundational awareness of information literacy concepts but require targeted support in advanced practical application. This study successfully achieved its two stated research objectives: 1) the priority needs assessment identified developing a conceptual research framework ($PNI_{\text{modified}} = .320$) and applying strategic search methods ($PNI_{\text{modified}} = .289$) as the most urgent competency gaps; and (2) the confirmatory factor analysis validated the ACRL Framework's six-factor structure within the Thai context ($\chi^2/df = 2.99$, RMSEA = .06, CFI = .95), confirming its structural integrity for IL assessment purposes. The gap between students' theoretical awareness of IL and their practical application is empirically grounded in the PNI_{modified} data and further explained by the qualitative findings—particularly the themes of AI dependency and ethical disconnection. The ACRL Framework is a strong and useful structural model for defining, measuring, and explaining the complex information competencies needed for students to succeed in today's higher education environment. The primary limitation of this research is the use of self-reported data, which reflects students' perceptions of their abilities rather than directly measured performance. Additionally, since the sample population was limited to students within the context of a higher education institution, educators and policy makers must use caution when applying the findings of this research to other levels of education or learning environments due to the potential for different learning environments and developmental characteristics to affect student outcomes. For institutions of higher education to close the gap between students' theoretical knowledge of information literacy and their practical application of such skills, institutions of higher education must fundamentally shift their instructional approaches to include highly experiential, hands-on learning experiences.

Information literacy cannot be simply taught theoretically; it must be learned through the application of skills to solve real-world problems. As such, universities must engage in the aggressive integration of active, inquiry-based learning into their curricula. Furthermore, based on the empirically identified gaps, the evidence suggests that IL instruction may be more effective when embedded across disciplinary coursework rather than delivered as isolated library orientations. The validated CFA model further suggests that assessment instruments aligned with the six ACRL dimensions may provide universities with a reliable and culturally appropriate tool for benchmarking students' IL development over time. Future research may benefit from longitudinal designs and performance-based IL assessments to move beyond self-report measures.

■ Ethics

This research was approved by the Chulalongkorn University Institutional Review Board (IRB), Multi-institutional Group 2—Social Sciences, Humanities, and Arts (Project No. 670149; approved July 24, 2024).

■ Declaration of Generative AI

Artificial intelligence was utilized exclusively for language polishing, grammar correction, and structural formatting to improve readability. All research design, data collection, statistical analyses, and core intellectual conclusions are the entirely original work of the authors.

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■ Declaration of Competing Interest

The authors affirm that there are no conflicts of interest associated with the conduct of this study.

■ Author Contributions

Rabiab Sangchantr: Writing – original draft, Writing – review & editing Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization. **Jintavee Khlaisang:** Writing – review & editing, Project administration, Supervision, Validation. **Prakob Koraneekij:** Writing – review & editing, Project administration, Supervision, Validation.

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