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The Landscape of Digital Technology to Enhance the Digital Researcher

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Abstract

The objectives of this research were to synthesize the competencies of the digital researcher, carry out an empirical investigation of the digital researcher landscape, and evaluate the results of a synthesis of digital researcher competency. To conduct the research, the researchers carried out a review of the literature related to researcher competency, digital competency, digital researcher competency and digital technology for researchers. Then, a focus group discussed the conclusion of the digital technology landscape used to enhance the digital researcher. The results showed that digital researchers' competency had six features: 1) Personalize and Security Competency, 2) Literature Review and Reference Management Competency, 3) Communication and Collaboration Management Competency, 4) Analyzing and Reporting Competency, 5) Proofreading and Plagiarism Checking Competency, and 6) Publication Competency.

Keywords: digital competency, research competency, digital researcher competency, digital researcher landscape

1. Introduction

The primary goal of research is to guide action, gather evidence for theories, and contribute to the growth of knowledge in data analysis. This article discusses the importance of research and the multiple reasons why it is beneficial for everyone (Linthaluek et al., 2020). Each stage of the research process uses technology to support different research (UMMAS BOSTON, 2011; University of Hull, 2022; Wikipedia, 2021). With rapidly changing technology, various activities are possible. Tools and innovations are available to help researchers operate conveniently and easily. The same applies to research-related activities, where there are many new technologies. This requires researchers and academics to modify the way research is conducted, also known as upskill development. Also, rebuilding skills are needed (reskill) to cope with changing technologies and processes (Songsangyos et al., 2021). For example, using technology to collaborate, planning, data analysis, dashboarding, submitting research for publication, language translation, reviewing literary copying, or even looking at privacy and security management in the digital world. All of the above tools will become the new normal in today's research operations. Therefore, a framework is required for digital researcher competency that is in line with current research methods and technologies. Also, for the development of research personnel this must be in line with the national strategy of research and innovation.

2. Literature Review

The researchers conducted a review involving researcher competency, digital competency, digital researcher competency, and digital technology for the researcher. The details are as follows.

2.1 Researcher Competency

Researchers conduct systematic research to answer questions. There is an established methodology in each related science that covers the concepts, plans and methods that are used to collect and analyze data (NIDA, 2017). To synthesize researchers' competency, the researchers conducted research and compiled a document that discussed the characteristics and abilities of the researchers. (Kannikar et al., 2021) For example, De la Llana Pérez et al. (2020) analyzed the development of students' research skills at the Institute of Technology of Professions, Commercial Administration and Training, by using structural equations or SEM to present the results. The findings suggest that what is important in managing research learning is to improve processes by providing students with the skills to find answers, define, explain, analyze, and even criticize scientific production. Analysis and synthesis can be summarized in the following Table 1.

Table 1. Synthesis of research competency

No.	Research Competency	(Vitae, 2010)	(NIDA, 2017)	(Thongsong et al., 2020)	(World Health Organization, 2016)	(Prosekov et al., 2020)	(Johns Hopkins University, 2021)
1	Knowledge and Intellectual Abilities						
1.1	Understand the issues of research	/		/		/	/
1.2	Knowledge of preliminary research						/
1.3	Write a conceptual framework in research			/			
1.4	Knowledge of research design			/			
1.5	Knowledge and application of research methodology	/	/				/
1.6	Knowledge of basic statistics				/		/
1.7	Knowledge of searching for information	/	/	/			
1.8	Know the information and manage it	/			/		
1.9	Knowledge of language and research terms	/					
1.10	Academic and numeracy	/			/		
1.11	Analyze, synthesize, evaluate, solve	/	/				
1.12	Knowledge of multicultural connections		/		/		/
1.13	Have the knowledge to write a report on the findings.			/			
2	Research Skill						
2.1	Plan and formulate operational strategies	/			/	/	/
2.2	Literature review			/		/	/
2.3	Writing project proposals for grants						/
2.4	Have the ability to communicate				/		/
2.5	Presentation of research and data visualization				/		
2.6	Experiment, collect, analyze, and summarize the findings				/		/
2.7	Resource management and teamwork				/	/	/
2.8	Write a research report			/	/	/	
2.9	teaching						/
3	Attribute and Attitude						
3.1	There is a good attitude towards research						
3.2	Punctuality						
3.3	Have patience, there was effort	/					
3.4	Responsible						
3.5	Enthusiastic	/					
3.6	Be honest, be honest with the information collected	/		/			
3.7	Open your heart to other people's opinions			/			
3.8	Self-confidence	/					
3.9	Faith in research						
3.10	Aspire to study						
3.11	Likes to write, likes to record knowledge						
3.12	Energetic, dreamy - there is a desire for academic progress						
3.13	Observant, curious	/					
3.14	Be creative	/					
3.15	Leadership						/

3.16	Comply with health and safety standards	/	/	/
3.17	Does not infringe intellectual property	/	/	/
3.18	There is a research ethics in humans	/	/	/
3.19	Deal with conflicts of thought and other conflicts	/	/	/
3.20	Take into account the impact of the research process on the community, society and environment	/	/	/

2.2 Digital Competency

Table 2. Synthesis of digital competency

No.	Digital Competency	(Fraile et al., 2018)	(Bryn Mawr College, 2021)	(ONDC of Thailand, 2019)	(Shiferaw et al., 2020)	(Khan et al., 2021)
1	Digital Content Creation					
1.1	Creating and producing digital content	/	/	/	/	/
1.2	Integrating and improving digital content	/		/	/	
1.3	Copyright and license management	/			/	
1.4	Computational thinking and programming	/	/	/	/	
2	Personalize and Safety					
2.1	Digital Identification Management	/	/	/	/	
2.2	Protecting personal information and privacy	/			/	
2.3	Cleaning, organizing, and managing data					
3	Planning and Problem Solving					
3.1	Technical troubleshooting	/		/	/	/
3.2	Skill modification in the digital age			/		/
3.3	Identifying technological needs	/			/	/
3.4	Creation using digital technology	/			/	/
3.5	Identifying digital capability gaps	/			/	/
4	Data Management and Preservation					
4.1	Search and filter data	/	/	/	/	
4.2	Evaluation of data suitability	/			/	
4.3	Data Management	/	/		/	
4.4	Data Analysis			/		/
4.5	Visual presentation of information		/			
5	Communication and Collaboration					
5.1	using digital technology	/			/	
5.2	Dissemination of information through digital technology	/	/		/	
5.3	Participation in citizenship through digital technology	/			/	/
5.4	Collaboration through digital technology	/	/		/	/
5.5	Having the etiquette of using digital technology	/		/	/	/
6	Attitude					
6.1	Flexibility and adaptability			/		
6.2	Leadership			/		/
6.3	Self-taught			/		/
6.4	Having the etiquette of using digital technology					

2.3 Digital Researcher

Digital researchers use digital technologies such as computers, smartphones and the Internet to support research

(Wikipedia, 2021). Moreover, digital researchers are people who use social media applications or tools to conduct research, such as Zotero and Evernote. They use applications to read PDFs and annotate them, or they may use QDA tools or software that enables them to carry out qualitative research. NVIVO is one type of software that uses tools to collaborate online, such as Dropbox (UMMAS BOSTON, 2011). The University of Hull (University of Hull, 2022) has also developed a curriculum to develop the digital researcher, with the content of the course including: Building online identity as a researcher, Online research dialogues, Online safety and intellectual property, Conducting research online, Ethics & Research Data Management (RDM), etc.

In summary, the definition of a digital researcher refers to those who have the ability to conduct research and use digital technology to support, manage, summarize, and publish research.

2.4 Digital Researcher Competency

Digital researcher competency is the ability of individuals with the knowledge, skills and attitudes or attributes in research, and can use digital technology for research purposes.

3. Research Objective

1) To synthesize digital researcher competency
2) To empirically investigate the digital researcher landscape
3) To evaluate the results of the synthesis of digital researcher competency

4. Methods

The research methodology is divided into three steps according to the research objectives as follows:

STEP 1: Synthesize digital researcher competency

STEP 2: Empirically investigate the digital researcher landscape

STEP 3: Evaluate the results of the synthesis of digital researcher competency

Table 3. Research methods

Step	Process	Results
STEP 1: Synthesize digital researcher competency	1) Synthesize researcher competency 2) Synthesize digital competency 3) Synthesize digital researcher competency	Draft Digital researcher competency
STEP 2: Empirical investigation of the digital researcher landscape	1) Review the literature on digital tools in research 2) Group tools by Digital researcher competency 3) Presented as Digital researcher landscape	Digital researcher landscape
STEP 3: Evaluate the results of the synthesis of digital researcher competency	1) Create assessment 2) Hold Focus Group events to debate the details of Digital researcher competency. 3) Expert assesses suitability of Digital researcher competency 4) Revised and updated according to the recommendations of expert.	Digital researcher competency has been assessed appropriately by expert.

5. Results

5.1 Digital Researcher Competency

A form analyzing and synthesizing researcher competency and digital competency was developed. We selected essential competency, and many researchers agreed this was an important competency for researchers and digitalists, while briefing readers on the connection and consistency of researcher competency and digital competency. This is shown in Figure 1 below.

Figure 1. Consistency between digital competency and researcher competency

The results of a synthesis of research competence and digital competence showed that both types of research had competencies that were consistent with one another. There is a large amount of knowledge, skills, and many attributes of researcher competency that align with digital competency. The researchers then synthesized or extracted digital researchers' competency by obtaining the complex part of 2 performance to become "Digital Researcher competency".

The results showed that digital researchers should have six competencies. These are: 1) Personalize and Security Competency, 2) Literature Review and Reference Management Competency, 3) Communication and Collaboration Management Competency, 4) Analyzing and Reporting Competency, 5) Proofreading and Plagiarism Checking Competency, and 6) Publication Competency.

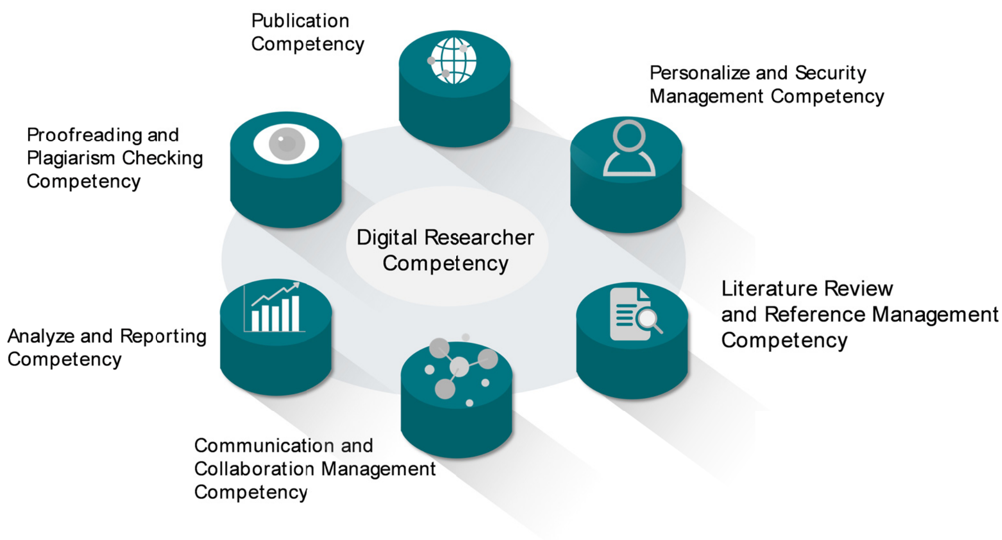

Figure 2. Digital researcher competency

Competency 1: Personalize and security competency

The capacity by which researchers can enter digital citizenship on the research ecosystem. Researchers must be present or profiled on information systems and have research displayed on online databases and can manage the privacy of personal data and research data for security reasons.

Table 4. Personalize and security competency

C1	Personalize and security competency
C11	Researcher identity competency
C12	Research identity competency
C13	Privacy and security management competency

Competency 2: Literature review and reference management competency

A competency that requires the ability to access and research documents. Research from online databases can assess the quality of documents and the research collected. References in content can also be managed, while automated references or bibliographies can be created using digital technology.

Table 5. Literature review and reference management competency

C2	Literature review and reference management competency
C21	Literature review competency
C22	Critical appraisal competency
C23	Reference management competency

Competency 3: Communication and collaboration management competency

The capabilities available can use digital technology to communicate and work together without time constraints in order to collaborate and communicate with each other at anytime and anywhere.

Table 6. Communication and collaboration management competency

C3	Communication and collaboration management competency
C31	Planning and research team management competency
C32	Communication competency
C33	Collaboration competency

Competency 4: Analyzing and reporting competency

A competency that researchers must have: the ability to collect data, analyze data and to visually present data to provide research reports using digital technologies.

Table 7. Analyzing and reporting competency

C4	Analyzing and reporting competency
C41	Data collection competency
C42	Data analyze competency
C43	Data visualization competency
C43	Reporting competency

Competency 5: Proofreading and plagiarism checking competency

Researchers must have the competency to use digital technology that can translate languages. Proofreading or grammar checking in different languages checks literacy.

Table 8. Proofreading and plagiarism checking competency

C5	Proofreading and plagiarism checking competency
C51	Language translation competency
C52	Proofreading competency
C53	Plagiarism competency

Competency 6: Publication competency

The competency of researchers to use digital technology to select academic conferences or journals, that are appropriate for themselves, or appropriate for the research they have produced, in addition to digital platforms that can also be used to submit academic articles.

Table 9. Publication competency

C6	Publication competency
C61	Conference Selection competency
C62	Journal Selection competency
C63	Publication Platform competency

5.2 Digital Researcher Landscape

The digital researcher landscape is the total collection of tools, software and digital technology that digital researchers use to support research. By offering software and digital technology for digital researchers based on the digital researcher that synthesized in the previous research process in the following Figure 3.

Figure 3. Digital researcher landscape

Table 10. Digital technology to enhance digital researcher

ID	Competencies	Digital Tools
C1	Personalize and Security competency	
C11	Researcher identity competency	ORCID ID Scopus ID Google Scholar Profile Publons Dialnet
C12	Research identity competency	Google Scholar Academia Research Gate ORCID ID Microsoft Academic DOI
C13	Privacy and security management	ORCID ID Scopus ID Google Scholar Profile Publons Dialnet
C2	Literature review and reference management	
C21	Literature review competency	TCI, Scopus Google Scholar Matrix Journal Master List Web of Science Science Direct Pubmed
C22	Critical appraisal competency	Rayyan Covidence JBI SUMARI RevMan DistillerSR SR Toolbox
C23	Reference management competency	Endnote Mendeley Zoteo Docear JabRef RefWorks ReadCube Qiqqa
C3	Communication and collaboration management	
C31	Planning and research team management competency	Tello Task Ganttpro Microsoft Project
C32	Communication competency	Email Zoom WebeX Google Meet Microsoft Teams Discord Line Facebook

C33	Collaboration competency	Miro Google Workspace Microsoft 365
C4	Analyzing and Reporting	
C41	Data collection competency	Google form Microsoft form SurveyMonkey Qualtrics Typeform
C42	Data analyze competency	Excel Google Sheet SPSS AMOS Nvivo R
C43	Data visualization competency	PowerPoint Photoshop Illustrator Canva Excel Infogram Google Data Studio Power BI
C44	Reporting competency	Microsoft Word Google Doc Latex
C5	Proofreading and plagiarism checking	
C51	Language translation competency	Google Translate MS Word Line WhiteSmoke
C52	Proofreading competency	Proofreading Grammarly QuillBot Linguix PaperRater
C53	Plagiarism competency	Turnitin WhiteSmoke Copyscape QuillBot Wordtune
C6	Publication	
C61	Conference selection competency	Conference alert
C62	Journal selection competency	SJR Bellist Journal Finder
C63	Publication platform competency	EasyChair OJS EDAS IConference

5.3 Result of Evaluation

After analyzing the digital researcher landscape, the researchers assessed their suitability using the focus group assessment using nine experts, including education, technology and competency experts. Discuss, comment and suggest digital researcher landscape. This is shown in the following table.

Table 11. Result for evaluation digital researcher landscape

Competency	$\bar{x}$	S.D.	Result
Personalize and Security Competency			
Researcher Identity	5.00	0	Absolutely Appropriate
Research Identity	5.00	0	Absolutely Appropriate
Privacy and Security Management	4.80	.45	Absolutely Appropriate
Literature Review and Reference Management Competency			
Literature Review	5.00	0	Absolutely Appropriate
Critical Appraisal	5.00	0	Absolutely Appropriate
Reference Management	5.00	0	Absolutely Appropriate
Communication and Collaboration Management Competency			
Planning and Research Team Management	4.80	.45	Absolutely Appropriate
Communication	5.00	0	Absolutely Appropriate
Collaboration	5.00	0	Absolutely Appropriate
Analyzing and Reporting Competency			
Data Collection	4.80	.45	Absolutely Appropriate
Data Analyze	4.80	.45	Absolutely Appropriate
Data Visualization	5.00	0	Absolutely Appropriate
Reporting	4.80	.45	Absolutely Appropriate
Proofreading and Plagiarism Checking Competency			
Language Translation	4.60	.55	Absolutely Appropriate
Proofreading	4.80	.45	Absolutely Appropriate
Plagiarism	5.00	0	Absolutely Appropriate
Publication Competency			
Conference Selection	4.80	.45	Absolutely Appropriate
Journal Selection	4.80	.45	Absolutely Appropriate
Publication Platform	4.80	.45	Absolutely Appropriate
Overall	4.88	.24	Absolutely Appropriate

6. Discussion

The digital technology landscape to enhance the digital researcher shows that digital researchers have six core competencies. These are: 1) Personalize and Security Competency, 2) Literature Review and Reference Management Competency, 3) Communication and Collaboration Management Competency, 4) Analyzing and Reporting Competency, 5) Proofreading and Plagiarism Checking Competency, and 6) Publication Competency. They also have 19 sub competencies. This is due to the integration of the research competencies and the digital competencies that researchers should have to become competent in digital research. As for researcher competency, this is consistent with Vitae's (2010) research, and that of Nida (2017), Thongsong et al. (2020), the World Health Organization (2016) Prosekov, Morozova, and Filatova (2020), Johns Hopkins University (2021), and Prosekov, Alexander, Irina, and Filatova (2020). Digital competency is also aligned with the European Commission (Fraile et al., 2018), Bryn Mawr College (2021), Office of the National Digital Economy and Society Commission in thai (ONDE of Thailand, 2020), Shiferaw et al. (2020), and Khan et al. (2021). Therefore, an evaluation of the results of the analysis and design of the digital technology landscape to enhance the digital researcher, shows that these are suitable and can be used as a framework for the further development of education and research. Finally, the digital research landscape is important because it's arguably the challenging part to control, so you may need to adapt to it instead of trying to direct it.

7. Conclusion

Based on the study's findings and discussion, it can be explained that the landscape of digital technology enhance the digital researcher It's research with new knowledge. Because today's digital research landscape isn't the same as what we saw ten years ago or even two years ago. The passage of time has also shown us which areas change quickly and which are more reliable for research. The assessment of the landscape of digital technology enhance the digital researcher was discussed, suggested and was certified by eight experts. The results revealed that the experts had a consensus on landscape of digital technology enhance the digital researcher In accordance with the research process using various research methodologies, which makes the research process with was synthesized for the digital researcher competency of graduate students, teacher and instructor that requires digital tools to conduct research, which will be a conclusion and guide research in the digital era and helps to promote or develop research to create a new integrated science And can use digital technology for research appropriately and in accordance with the new research context. New way of life and the transformation of new digital technologies.

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