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COMPARATIVE ANALYSIS OF DIGITAL LITERACY AND 21ST-CENTURY SKILLS AMONG UNIVERSITY GRADUATES IN MALAYSIA AND INDONESIA: THE ROLE OF COLLABORATION, CRITICAL THINKING, COMMUNICATION, AND CREATIVITY

[1]Noor Azli Affendy Lee, [2]Farina Nozakiah Tazijan, [*1]Aileen Farida Mohd Adam, [3]Ikhsanudin & [1]Rofiza Aboo Bakar

[1] Academy of Language Studies, Universiti Teknologi MARA, Cawangan Pulau Pinang, 13500 Permatang Pauh, Pulau Pinang, Malaysia.
[2] Academy of Language Studies, Universiti Teknologi MARA Shah Alam, 40450 Shah Alam, Selangor, Malaysia.
[3] Faculty of Teacher Training and Education, Universitas Tanjungpura, Kalimantan Barat 78124, Indonesia.
[*]Corresponding Author: aileen@uitm.edu.my

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ABSTRACT

Background and Purpose: Digital literacy and 21st-century skills are increasingly needed to navigate today's globalized society. Recent study emphasises the necessity of these abilities for youngsters to actively participate in digital societies, civic and political affairs, and digital identity exploration. This study aims to compare the digital literacy and 21st-century skills of university graduates in Malaysia and Indonesia, and to examine how these skills shape digital literacy in both countries.

Methodology: 113 Malaysian and 271 Indonesian graduates participated in the online survey. The questionnaire was developed to measure the four determinants of digital literacy: Critical Thinking, Collaboration, Communication, and Creativity & Innovation. The core analysis assessed levels of each determinant using mean scores from survey responses. One-sample T-test and ANOVA test determined the significance of each determinant with relation to digital literacy. This methodology combined quantitative survey data with statistical analysis to gain insights into the digital literacy competencies of university students in both countries.

Findings: Findings indicate both countries' graduates possess strong digital competencies, with variations in skill proficiency and technology use reflecting socio-economic and educational factors. Collaboration skills notably exceed digital literacy expectations, highlighting cultural or educational emphases on teamwork. The study suggests enhancing digital infrastructure and educational programs to address identified gaps, advocating for tailored approaches to improve digital literacy and skill development.

Contributions: This research contributes to understanding digital literacy in the digital age, emphasizing the necessity of 21st-century skills for academic and professional success.

Keywords: Digital literacy and 21st-century skills, collaboration, critical thinking, communication, creativity.

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1.0 INTRODUCTION

Digital literacy and 21st-century skills are crucial for navigating today's globalised environment. Recent research highlights the importance of these skills for youth to participate in digital societies, engage civically and politically, and explore their digital identities. The digital environment presents both challenges and opportunities, necessitating a comprehensive approach to digital citizenship that includes safety, well-being, and active engagement (Cortesi et al., 2020). In the context of the fourth industrial revolution, digital competencies are essential for sustainable development, supported by digital literacy frameworks (Khoroshilov, 2021). These competencies are vital for life, work, and creativity, underscoring the need for a unified approach to digital literacy education (Khlaisang & Yoshida, 2022).

Technology has transformed education in today's globalized society, highlighting the importance of digital literacy for graduates. These innovations have made learning more dynamic, flexible, and accessible via digital tools and resources. Modern educational platforms have revolutionized content delivery, communication, and collaboration, preparing graduates for digital workplaces (Khoroshilov, 2021). Technology has also enabled global connectivity and collaborative learning, removing geographical barriers and boosting cross-cultural encounters (Cortesi et al., 2020). The COVID-19 pandemic's shift to remote and hybrid

learning underlined digital literacy's importance in leveraging online platforms and resources (Tejedor et al., 2020). Additionally, digital literacy underpins 21st-century skills like critical thinking and effective communication, essential for the modern workforce (Yoo, 2022). Digital literacy helps students evaluate and use information for academic and lifelong learning (Churchill, 2020). Finally, technological advances have personalised learning for different needs and styles, improving engagement and academic performance (Khlaisang & Yoshida, 2022).

Malaysia's efforts to sustain prosperity through digitally competent graduates show how socio-economic and educational factors affect digital literacy and skill development. Implementing digital literacy frameworks, preparing educational institutions to use digital technologies, and closing the digital divide are major challenges, especially among B40 low-income groups. Limited access to digital technology makes digital literacy challenging (Khan et al., 2022; Mohamed et al., 2022). The Penang Young Digital Talent Programme helps young Malaysians meet market demands by emphasising digital content creation, information and data literacy, and problem-solving (Kee et al., 2023). Malaysia's education system incorporates ICT into its curriculum to support the transition to a digital economy and prepare society and the workforce for the digital age (Bujang et al., 2020). This comprehensive approach recognizes digital competencies as indispensable for the modern workforce, emphasizing the importance of effective digital literacy education in preparing young graduates for future challenges.

Indonesia is committed to growing the digital economy and bridging the digital divide, and socio-economic and educational factors strongly influence digital literacy and skill development. Indonesian youths are at a "developing readiness" phase for the digital economy, highlighting the need for digital literacy, financial literacy, and soft skills programmes (Amidjono et al., 2022). According to Putra et al. (2022) and Supartoyo (2022), digital literacy accelerates digital transformation and economic recovery, with the National Digital Literacy Movement aiming to train 12.5 million Indonesians annually until 2024. Additionally, Parianom et al. (2022) advocate for increased digital literacy in the MSME sector to help them overcome economic obstacles and thrive post-pandemic. Wahjusaputri and Nastiti (2022) believe that vocational education needs digital literacy competence indicators to increase learning and adapt to online education. Marini et al. (2020) also address Indonesian women's digital divide and how digital literacy might improve their quality of life and digital economy participation. These studies depict Indonesia's comprehensive digital literacy and skills strategy

to address socio-economic challenges and capitalize on digital transformation for inclusive growth.

This paper aims to provide insights into the preparedness of university graduates in Malaysia and Indonesia for the challenges and opportunities presented by the digital era, emphasising the transformative roles of collaboration, critical thinking, communication, and creativity in shaping digital literacy. The research questions are as follows:

1. How do university graduates in Malaysia and Indonesia compare in terms of their digital literacy and proficiency in 21st-century skills (Collaboration, Critical Thinking, Communication, and Creativity)?
2. What is the role and significance of Collaboration, Critical Thinking, Communication, and Creativity in shaping digital literacy among university graduates in these countries?
3. Are there any notable differences in the impact of these skills on digital literacy between Malaysian and Indonesian graduates?

2.0 LITERATURE REVIEW

2.1 Digital Literacy and 21st-Century Skills

Digital literacy and 21st-century skills literature has evolved significantly in response to the rapid technological advancements and the integration of digital tools in education, particularly in Southeast Asia and beyond. Research on digital literacy and 21st-century skills in Southeast Asia and elsewhere provides insights into their development, application, and impact.

Silber-Varod et al. (2019) discovered that educational literature mainly discusses communication, problem-solving, and teamwork as digital literacy skills. Their findings indicate a marginal awareness of digital learning competencies in educational research, suggesting a gap between the evolving digital competencies needed and the focus of current educational research (Silber-Varod et al., 2019). The pandemic has highlighted the importance of digital literacy in education. Kusumastuti and Nuryani (2020) examined ASEAN digital literacy levels and policy where they found that ASEAN countries face similar challenges and opportunities in enhancing digital literacy to succeed in the digital age. The COVID-19 epidemic damaged marginal workers' digital literacy and job prospects in selected ASEAN countries (Intaratat, 2022). Government policies should support digital reskilling and upskilling, especially for marginalised workers, to meet future job demands (Intaratat, 2022). Tejedor et al. (2020) examined how Spanish, Italian, and Ecuadorian higher education institutions used digital literacy adapted to the global lockdown. The study recommends

enhancing teachers' digital skills, adapting learning resources, and improving communication between universities and students to improve digital literacy education amid crises (Tejedor et al., 2020). Digital literacy for global citizens includes self-initiation, trendiness, usefulness, and a positive attitude, according to Khlaisang and Yoshida (2022). Their findings show that students require self-learning tools and smart wearable technologies to learn personally and independently in the digital age (Khlaisang & Yoshida, 2022).

Malaysian education policies and strategies promote digital literacy and 21st-century skills, showing a national commitment to modernizing education. Rahman et al. (2020a) examine rural schoolteachers' preparedness for integrating multimedia tools to enhance preschoolers' language abilities, reflecting the efforts to incorporate 21st-century learning techniques in rural preschools through interactive multimedia sessions. Similarly, Rahman et al. (2020b) examine how multimedia affects early literacy in rural preschools, highlighting modern language development approaches in multimedia formats. Tohara et al. (2021) proposes a digital literacy model for students with special needs, focusing on cognitive skills, technology use, and ethics. This approach promotes inclusive education, ensuring all students benefit from digital advancements. According to Khan et al. (2022), digital literacy helps young graduates adapt to digital work environments, identifying essential skills and learning styles for academic success and employability. This study calls emphasizes the need for clear guidelines to better prepare graduates for the digital workforce. Additionally, a survey conducted by Shuhidan et al. (2022) among Malaysian secondary school students indicates a positive correlation between digital literacy and learning engagement. The findings suggest that socio-cultural factors, the learning environment, and individual characteristics significantly influence students' engagement, highlighting the need of digital literacy in improving education (Shuhidan et al., 2022).

Indonesian educational policies are actively incorporating digital literacy and 21st-century skills into the curriculum to bolster student competencies. Rizaldi et al. (2020) propose that STEM education must emphasize digital competency to teach 21st-century skills. In addition, Suherman et al. (2020) found that digital literacy programmes in a rural West Java community helped improved e-library use and resource management. The COVID-19 pandemic underscored the significance of digital literacy in education. Endrayanto et al. (2022) recommend proactive policymaking and community involvement to mitigate online risks and promote digital literacy in educational settings. A systematic literature review by Purnama et al. (2022) on digital storytelling in early childhood education in Indonesia emphasizes the necessity of digital literacy from an early age. Furthermore, a study by Wahjusaputri and

Nastiti (2022) discovered four competency factors and 28 indicators, establishing the framework for an Indonesian vocational education digital literacy assessment model.

Previous research studies underscore the significance of collaboration, critical thinking, communication, and creativity—often referred to as the 4Cs—in shaping digital literacy and 21st-century skills across various educational landscapes. Digital literacy relies on these core competencies to enable individuals to adapt, thrive, and innovate within the rapidly evolving digital world. Digital literacy efforts emphasise these 4Cs to meet 21st-century education needs. By integrating collaboration, critical thinking, communication, and creativity into digital literacy frameworks, educational systems worldwide are equipping students with the skills necessary to navigate the complexities of the digital age, ensuring they are prepared for future challenges and opportunities. These competencies enhance individual capabilities and also produce a resilient, innovative, and interconnected global society.

2.2 Collaboration

Collaboration is key to digital literacy and preparing both students and educators for today's digital society and workforce. Integrating collaborative skills into digital literacy efforts helps individuals to effectively navigate and contribute to digital spaces. According to Wijaya (2020), teachers can encourage digital literacy, including collaboration, by developing exploratory learning projects that improve students' digital competences. The study recommends that teachers create technology-assisted assignments that stimulate exploration to teach digital literacy (Wijaya, 2020). Similarly, Yulhendri et al. (2021) advocate for Project-Based Learning to foster creativity, critical thinking, communication, and collaboration for digital success. This approach emphasises the transformative potential of collaborative learning experiences in aligning educational outcomes with 21st-century demands by equipping students with the skills they need to navigate the digital, internet, and industrial revolutions (Yulhendri et al., 2021). A study by Hidayat et al. (2022) focused on training Central Java science teachers in digital collaboration. This training was essential due to the COVID-19 pandemic's impact on traditional classroom settings, demonstrating the importance of digital collaboration skills in maintaining effective learning environments during remote education. The program reinforced and mapped digital cooperation competencies for science education's digital-based learning and group activities (Hidayat et al., 2022).

2.3 Critical Thinking

Critical thinking is essential for modern problem-solving and digital technology use. George-Reyes et al. (2021) examine how computational thinking and digital literacy combine to emphasise critical thinking. This integration is crucial for preparing 21st-century professionals to utilize technology effectively in educational contexts, demonstrating that critical thinking facilitates the understanding and application of digital tools and concepts (George-Reyes et al., 2021). Kahar et al. (2021) emphasise critical thinking along with digital literacy, information literacy, and ICT mastery for navigating the Industrial Revolution 4.0 and Society 5.0, while Yulhendri et al. (2021) believe students need critical thinking to adapt to the digital, internet, and industrial revolutions and improve their problem-solving skills. Mahmud and Wong (2022) found that critical thinking is crucial for career readiness, workplace success, and innovative problem-solving.

2.4 Communication

Communication is essential to digital literacy and thriving in today's tech-driven culture. Reddy et al. (2020) provide a comprehensive review of the growing impact of ICT on education, stressing digital literacy, including communication, as essential for digital world navigation. They emphasize the emergence of digital literacy as pivotal in adapting to the modern age and the need for a range of abilities, including effective communication, to succeed in the digital world (Reddy et al., 2020). George-Reyes et al. (2021) and More (2021) emphasise communication skills in digital literacy frameworks, with More focusing on e-newspaper access. Many students utilise the internet for e-newspapers, demonstrating the importance of digital literacy in improving communication skills across digital platforms (More, 2021). Yulhendri et al. (2021) emphasize communication, along with other 4Cs skills, as crucial for students in the digital age.

2.5 Creativity

Creativity in digital literacy and 21st-century skills is increasingly recognised as essential for students and professionals to think creatively and solve problems. Wijaya (2020) and Komalasari (2021) stress the importance of creativity in developing digital competencies and engaging with diverse perspectives. Educators should provide technology-assisted tasks that encourage exploration and creativity to improve digital literacy and problem-solving (Wijaya, 2020). Furthermore, creativity is found to foster intercultural communicative competence and digital literacy. Yulhendri et al. (2021) note creativity's role in adapting to the modern world

through Project-Based Learning. This approach emphasises the need for creativity to adapt to the digital, internet, and industrial revolutions and inventive thinking to navigate the 21st century (Yulhendri et al., 2021). A study by Waliyuddin and Sulisworo (2022) show that AR and GS can enhance High Order Thinking Skills and digital literacy through creativity. This novel assessment approach reflects the importance of creativity in mastering digital competencies and navigating the digital landscape effectively (Waliyuddin & Sulisworo, 2022).

3.0 RESEARCH DESIGN

The questionnaire used in this study was adapted from previously validated instruments in digital literacy and 21st-century skills assessment. It was modified to suit the context of the study, focusing on the four determinants: Critical Thinking, Collaboration, Communication, and Creativity. This adaptation was based on frameworks developed by Silber-Varod et al. (2019) and Khlaisang and Yoshida (2022), which emphasize the importance of these competencies in the digital age. Each determinant was operationalized through specific items to capture various dimensions of these skills. For instance, 'Critical Thinking' included questions on analyzing evidence and generating follow-up questions to deepen understanding. 'Collaboration' measured the ability to work effectively within teams, respect diverse perspectives, and manage tasks. 'Communication' assessed participants' proficiency in organizing information, adopting appropriate styles for different audiences, and presenting ideas clearly. Finally, 'Creativity' captured respondents' capacity for idea generation, innovative thinking, and the integration of diverse elements into cohesive projects Additionally, the survey also included Likert scale items, demographic questions, and technology usage queries.

The study employed a non-probability convenience sampling method. The online survey was distributed randomly to students from the faculties where the researchers were actively teaching at the time of data collection. Participation in the survey was voluntary and not compulsory, ensuring that respondents chose to contribute without coercion. Although the survey was sent to students from specific faculties, the background and academic disciplines of the participants were not considered critical factors influencing the study's findings. Therefore, no stratification was applied based on faculty or demographic variables, as the focus of the research was on assessing digital literacy and 21st-century skills, independent of these characteristics.

Initial analysis involved descriptive statistics to understand the demographic profile of the respondents, their access to technology, and their primary uses of the internet and digital tools. The core of the analysis focused on assessing the levels of the four determinants using the survey responses. Items related to each determinant were analyzed to calculate mean scores, indicating the prevalence of each skill among the respondents. To examine the significance of each determinant in relation to digital literacy, one-sample T-tests and ANOVA tests were conducted. These tests compared the mean scores of each determinant against a predefined value or among the groups to identify significant differences and determinants. Based on the statistical tests, conclusions were drawn regarding the significant determinants of digital literacy among the respondents. The methodology thus combined quantitative survey data with rigorous statistical analysis to derive insights into the digital literacy competencies of university students in the given contexts.

4.0 FINDINGS

Online surveys were completed by 113 Malaysian and 271 Indonesian graduates. Both countries exhibit a young demographic, with the majority in the 18 to 24 age group. Malaysian respondents predominantly use smartphones, followed by laptops, whereas Indonesian respondents heavily favor desktop computers. The higher use of smartphones in Malaysia might be linked to a more mobile lifestyle or economic factors, while the preference for desktop computers in Indonesia could suggest a need for stationary work setups, possibly influenced by the nature of occupations or educational pursuits. In both countries, a significant portion of respondents experience limited internet access, with Indonesia having a slightly higher percentage. The lack of internet connection in both countries may affect education, professional development, and information access.

When it comes to the usage of technology, the data from Malaysian respondents suggests a strong focus on communication, social networking, and academic pursuits. There is a notable emphasis on using technology for educational purposes and maintaining social connections. On the other hand, Indonesian respondents use technology for a broader range of activities, with a similar emphasis on social interaction, academic research, and entertainment. The data shows a more balanced distribution across different uses compared to Malaysia. Both countries demonstrate the importance of technology in maintaining social connections and pursuing educational opportunities, aligning with worldwide digitization and the rise of online platforms.

Next, the findings compare survey data on critical thinking skills among respondents in Malaysia and Indonesia. In academic and professional settings, critical thinking includes analyzing evidence, recognizing context, and questioning successfully. The data shows how these skills are perceived in different educational or professional settings in the two countries. Respondents rated their proficiency in several aspects of critical thinking on a 5-point scale (1 being the lowest and 5 the highest). The survey items cover areas like revising drafts, developing questions, transferring knowledge, and evaluating information. The mean scores and standard deviations (SD) for each item provide a quantitative measure of self-assessed critical thinking skills as presented in Table 1.

Table 1: Measurement of self-assessed critical thinking skills

No	**Critical Thinking**	**Malaysia**		**Indonesia**	
1	Survey Item	**Mean**	**SD**	**Mean**	**SD**
2	Revise drafts and justify revisions with evidence.	3.97	.432	3.91	.735
3	Develop follow-up questions that focus or broaden the inquiry	3.86	.565	3.86	.774
4	Understand how knowledge or insights might transfer to other situations or contexts	3.85	.538	4.19	.703
5	Identify in detail what needs to be known to answer a science inquiry question.	3.90	.566	3.83	.772
6	Evaluate reasoning and evidence that support an argument.	3.98	.582	4.00	.691
7	Develop follow-up questions to gain understanding of the wants and needs	3.94	.468	3.69	.756
8	Understand questions that lead to critical thinking	3.71	.622	3.79	.782
9	Gather relevant and sufficient information from different sources	4.07	.477	4.07	.719
10	Justify choices of evaluation criteria	3.93	.437	3.80	.677
11	Thoroughly assess the quality of information.	3.96	.550	3.89	.730
12	Recognize the limitations of our design and know when to consider alternatives	3.90	.582	3.84	.684
13	**TOTAL**	**3.915**	**529**	**3.897**	**.729**

Table 1 shows Malaysian respondents' highest mean scores are observed in "Gather relevant information" (4.07) and "Evaluate reasoning and evidence" (3.98), indicating a strong self-perception in these areas. The lowest mean score is for "Understanding questions that lead to critical thinking" (3.71), suggesting potential for improvement. The total mean score is 3.915 with a SD of 0.529, indicating relatively high self-assessed critical thinking skills among

Malaysian respondents. Indonesian respondents rate themselves highest in "Understanding how knowledge transfers" (4.19) and "Gathering relevant information" (4.07), showing confidence in applying knowledge in different contexts and in research skills. The lowest mean score is for "Develop follow-up questions to understand needs" (3.69), which might imply a need for enhanced skills in probing and inquiry. The total mean score is slightly lower than Malaysia at 3.897, with a higher SD of 0.729, suggesting more self-assessment variation among Indonesian respondents. The data reflects a positive self-assessment of critical thinking skills in both countries. Malaysian respondents show a strong self-perception in evaluating reasoning and evidence, while Indonesians rate themselves highly in applying knowledge across contexts. The Indonesian data has a higher standard deviation, suggesting greater self-assessment variability due to a more diversified respondent pool, educational institutions, or cultural approaches to critical thinking. For Malaysians, understanding critical questions, and for Indonesians, developing inquisitive follow-up questions, were weaker areas. This points to potential gaps in inquiry-based learning and critical questioning education strategies.

The next analysis evaluates the self-assessed collaboration skills of respondents in Malaysia and Indonesia. Collaboration, a key component of successful teamwork in academic and professional settings, includes skills such as politeness, respect for others' perspectives, effective communication, and task management. The survey data provides insights into how these skills are perceived and valued in both countries. Respondents rated their proficiency in various aspects of collaboration on a 5-point scale. The survey items cover a range of collaborative skills, from interpersonal interactions to task and project management. Table 2 shows the mean scores and standard deviations (SD) for each item which offer a quantitative measure of self-assessed collaboration skills.

Table 2: Measurement of self-assessed collaboration skills

	COLLABORATION	**Malaysia**		**Indonesia**	
	Survey Item	**Mean**	**SD**	**Mean**	**SD**
1	Be polite and kind to course-mates	4.55	.517	4.49	.688
2	Acknowledge and respect other perspectives.	4.44	.550	4.45	.647
3	Follow the rules for team meetings.	4.19	.460	4.20	.655
4	Make sure all course-mates' ideas are equally valued.	4.19	.625	4.06	.641
5	Offer assistance to others in their work when needed.	4.16	.527	3.90	.790
6	Improve my own work when given feedback.	4.22	.608	4.20	.708
7	Use appropriate body language when presenting.	3.86	.718	3.90	.729
8	Come physically and mentally prepared each day.	3.97	.674	3.79	.955
9	Follow rules for course mates making.	4.08	.537	4.08	.689
10	Make detailed plans about the use of technology.	3.94	.587	3.77	.778
11	Make detailed plans about how to work together.	4.10	.582	3.90	.844
12	Use the time, and run meetings, efficiently.	4.01	.543	3.98	.809
13	Consistently use technology as agreed upon by the course mates to manage project tasks.	4.09	.576	4.11	.768
14	Complete research to contribute to the course mates.	4.09	.576	3.93	.680
15	Involve all course mates in tasks.	4.22	.623	3.94	.839
16	Interact with course mates effectively.	4.26	.563	4.17	.637
17	Assign roles as needed, based on course mates' strength.	4.00	.641	4.17	.637
18	Help resolve issues without asking the lecturers for help.	3.27	.869	3.24	.927
19	Provide feedback useful to course mates and lecturers	3.89	.557	3.77	.750
20	Create a task list that divides group work reasonably among course mates	4.04	.566	3.93	.682
21	Help the course-mates to solve problems and manage conflicts.	4.12	.563	3.99	.641
22	Track my progress toward goals and deadlines.	4.00	.612	3.86	.818
	TOTAL	**4.077**	**.594**	**3.99**	**.74**

Based on Table 2, the highest mean scores for Malaysian respondents are in "Be polite and kind to course-mates" (4.55) and "Interact with course mates effectively" (4.26), indicating strong self-perception in interpersonal skills. Skills such as "Follow rules for team meetings" (4.19) and "Make sure all course-mates' ideas are valued" (4.19) also received high ratings, showing a positive attitude towards structured teamwork. The lowest mean score is for "Help resolve issues without lecturer's help" (3.27), suggesting a reliance on external guidance for conflict resolution. The total mean score is 4.077 with a SD of 0.594, indicating a generally high self-assessment of collaborative skills. Similarly, their Indonesian counterparts score the

highest in "Be polite and kind to course-mates" (4.49) and "Acknowledge and respect other perspectives" (4.45), suggesting strong values in respectful communication. "Consistently use technology for managing tasks" (4.11) and "Interact with course mates effectively" (4.17) also rated highly, reflecting an appreciation for technology in collaboration. The lowest score is for "Help resolve issues without lecturer's help" (3.24), similar to Malaysia, indicating a potential area for improvement in independent problem-solving. The total mean score is slightly lower than Malaysia at 3.99, with a higher SD of 0.74, suggesting more variability in self-assessment. Both countries show a positive self-assessment of collaboration skills, particularly in aspects of interpersonal communication and respect. However, both Malaysian and Indonesian respondents indicate less confidence in resolving conflicts without external help, suggesting autonomous problem-solving and conflict management within teams could be improved. On a positive note, Indonesia's emphasis on technology in collaboration, aligns with global trends towards digital teamwork tools and platforms.

The third skill to be examined is communication. Communication skills are in academic, professional, and personal settings. The survey explores different aspects of communication, such as clarity, conciseness, style, and use of media. Respondents rated their proficiency in several communication skills on a 5-point scale. The survey items encompass organizing information, adopting suitable communication styles, presenting clearly, and using media effectively. Table 3 shows the mean scores and standard deviations (SD) to provide a quantitative measure of self-assessed communication skills.

Table 3: Measurement of self-assessed communication skills

	COMMUNICATION	**Malaysia**		**Indonesia**	
	Survey Item	**Mean**	**SD**	**Mean**	**SD**
1	Organize information well.	3.87	.620	3.94	.689
2	Adopt a communication style appropriate for the purpose, task, or audience.	4.00	.720	4.00	.694
3	Complete tasks without having to be reminded.	3.81	.819	3.76	.858
4	Present all information clearly, concisely, and logically.	3.94	.645	3.86	.787
5	Answer questions clearly and concisely.	3.81	.693	3.84	.727
6	Clearly communicate alternatives or opposing perspectives.	3.83	.640	3.74	.790
7	Speak clearly and professionally.	3.75	.819	3.65	.902
8	Create a clear and interesting introduction and conclusion	3.87	.634	3.77	.775
9	Use appropriate media to enhance understanding.	4.07	.664	4.29	.621
	TOTAL	**3.883**	**.695**	**3.872**	**.760**

Based on Table 3, Malaysian respondents show the highest mean score for "Use appropriate media to enhance understanding" (4.07), indicating confidence in using media as a communication tool. "Adopt a communication style appropriate for the purpose, task, or audience" (4.00) and "Present all information clearly, concisely, and logically" (3.94) also received high ratings. The lowest mean score is for "Speak clearly and professionally" (3.75), suggesting potential room for improvement in verbal communication skills. A mean score of 3.883 with an SD of 0.695 indicates generally high self-assessment of communication skills. Indonesian respondents rated themselves highest in "Use appropriate media to enhance understanding" (4.29), showing a strong confidence in integrating media into communication. "Adopt a communication style appropriate for the purpose, task, or audience" (4.00) and "Organize information well" (3.94) are also areas of strength. The lowest mean score is for "Speak clearly and professionally" (3.65), similar to Malaysia, indicating a common area for development. A lower mean score of 3.872 and a higher SD of 0.760 indicate more self-assessment variability than Malaysia. In summary, the findings from both countries reveals a strong self-assessment in key communication skills, particularly effective media use and appropriate communication styles. However, it also identifies a common area for improvement in verbal communication skills.

Lastly, this paper presents survey data on creativity skill in both countries. Creativity drives innovation and innovative solutions in many sectors. The survey explores different

aspects of creativity, including idea generation, elaboration of ideas, and combining elements into comprehensive projects. Respondents rated their proficiency in several creativity and innovation skills on a 5-point scale. The survey items encompass finding unique sources of information, creating and elaborating on ideas, brainstorming, and promoting diverse perspectives. Self-assessed creativity skills are quantified by mean scores and SD in Table 4.

Table 4: Measurement of self-assessed creativity skills

	CREATIVITY	**Malaysia**		**Indonesia**	
	Survey Item	**Mean**	**SD**	**Mean**	**SD**
1	Find sources of information and inspiration when others do not.	3.94	.747	3.89	.714
2	Create ideas geared to the research/projects.	3.88	.614	3.79	.706
3	Create new, unique, surprising research/projects.	3.73	.779	3.65	.856
4	Elaborate and improve on ideas.	3.91	.701	3.90	.711
5	Use brainstorming to generate original ideas.	3.84	.662	3.90	.748
6	Use creativity and imagination.	3.97	.687	4.18	.648
7	Promote a variety of creative perspectives.	3.80	.657	3.74	.766
8	Combine different elements into a complete research/projects.	3.88	.691	3.71	.816
	TOTAL	**3.868**	**.692**	**3.845**	**.746**

Malaysian respondents score the highest mean for "Use creativity and imagination" (3.97), indicating strong self-confidence in creative thinking (Table 4). "Elaborate and improve on ideas" (3.91) and "Find sources of information and inspiration" (3.94) also received high ratings. The lowest mean score is for "Create new, unique, surprising research/projects" (3.73), suggesting opportunity for improvement in developing original projects. The total mean score is 3.868 with a SD of 0.692, indicating a generally high self-assessment of creativity and innovation skills. Their Indonesian counterparts also rated themselves highest in "Use creativity and imagination" (4.18), showing strong confidence in their creative capabilities. "Elaborate and improve on ideas" (3.90) and "Use brainstorming to generate original ideas" (3.90) are also strong areas. The lowest mean score is for "Combine different elements into a complete research/projects" (3.71), indicating a potential area for development in synthesizing diverse elements into cohesive projects. The mean score is 3.845, lower than Malaysia, and the SD is 0.746, indicating larger self-assessment variability. Both countries show a positive self-assessment of creativity and innovation skills, particularly in using creativity and imagination.

However, there are areas identified for potential improvement, notably in creating unique and surprising projects in Malaysia and in combining elements into complete projects in Indonesia. Similar patterns in both countries reflect regional emphasis or shared educational approaches that promote creativity and imagination.

In order to examine the relationship between digital literacy and four key determinants: critical thinking, collaboration, communication, and creativity, this study uses a one-sample t-test to compare the means of these determinants against a test value (TV) of 0.79, representing a standard or expected level of digital literacy. The one-sample t-test assesses whether the mean score of each determinant significantly differs from the test value, indicating a deviation from the expected level of digital literacy. A p-value less than 0.05 is typically considered significant. This analysis uses a one-tailed test, which assumes that any significant difference will only be in one direction. The results are presented in Table 5.

Table 5: Relationship between digital literacy and four key determinants

	Malaysia		**Indonesia**		**Result**	**Outcome**
Determinants	1 sample test (TV=0.79)	P value (1 tailed)	1 sample test (TV=0.79)	P value (1 tailed)		
Critical Thinking	-1.138	.128	-.112	.455	Not Significant	There is no significant difference in the means of Critical Thinking and Digital Literacy
Collaboration	4.251	.000	3.566	.000	Significant	There is significant difference in the means of Collaboration and Digital Literacy
Communication	-1.527	.065	-.867	.193	Not Significant	There is no significant difference in the means of Communication and Digital Literacy
Creativity	-1.445	.059	-1.415	.079	Not significant	There is no difference in the means of Creativity and Digital Literacy

Table 5 indicates that in both Malaysia and Indonesia, critical thinking, communication, and creativity and innovation skills are generally in line with expected levels of digital literacy. However, collaboration skills in both countries significantly differ from digital literacy expectations, suggesting these skills are more developed than digital literacy. This significant difference in collaboration skills might reflect a cultural or educational emphasis on teamwork and group dynamics that exceeds the scope of traditional digital literacy. It could also suggest

that current digital literacy metrics may not fully capture or reflect collaborative competencies. Critical thinking, communication, and creativity and innovation correlate with digital literacy, suggesting that these skills are being adequately addressed in digital competencies. However, the distinct nature of collaboration skills points to a potential area for further digital literacy frameworks investigation and development.

Analysis of Variance (ANOVA) was used to compare differences in Malaysian and Indonesian respondents' critical thinking, collaboration, communication, and creativity skills. The ANOVA F-test determines if there are any statistically significant differences between the means of various groups for each determinant. The F-statistic and p-value are used to assess the significance of these differences. Table 6 shows F-statistics and p-values for each determinant in both nations. A statistically significant result ($p < 0.05$) suggests that at least one group mean is significantly different from the others.

Table 6: F-statistics and p-value for each determinant in both countries

Determinants	**ANOVA F**	**P value**	**Outcome**
		Malaysia	
Critical Thinking	10.928	0.00	There is statistically significant difference between groups by ANOVA (F (32,80) =10.928, p = 0.000
Collaboration	10.416	.000	There is statistically significant difference between groups by ANOVA (F (32,80) =10.416, p = 0.000
Communication	15.272	.000	There is statistically significant difference between groups by ANOVA (F (32,80) =15.272, p = 0.000
Creativity	13.355	.000	There is statistically significant difference between groups by ANOVA (F (32,80) =13.355, p = 0.000
		Indonesia	
Critical Thinking	34.870	0.00	There is statistically significant difference between groups by ANOVA (F (40,230) = 34.870 p = 0.000
Collaboration	24.855	.000	There is statistically significant difference between groups by ANOVA (F (40,230) = 24.855, p = 0.000
Communication	31.989	.000	There is statistically significant difference between groups by ANOVA (F (40,230) = 31.989, p = 0.000
Creativity	21.172	.000	There is statistically significant difference between groups by ANOVA (F (40,230) = 21.172, p = 0.000

Table 6 shows statistically significant differences among groups for all determinants. In both countries, communication skills exhibit the highest variability among groups, followed by creativity, collaboration, and critical thinking. This variability could be attributed to different educational approaches, cultural influences, or varying emphasis on these skills in different settings. The significant differences in collaboration and creativity skills might reflect the diverse ways these skills are developed and valued in different contexts. For example, collaborative projects or innovative tasks might be more emphasized in some educational or professional groups than others.

5.0 DISCUSSION

Digital literacy and 21st-century skills among Malaysian and Indonesian university graduates reveal their digital readiness. Khan et al. (2022) found that graduates are highly engaged with digital technology, highlighting the need for digitally literate employees to drive sustainable growth. However, device preferences and internet access vary significantly between Malaysian and Indonesian graduates, potentially influencing their digital literacy. Malaysian graduates' preference for smartphones could denote a flexible, mobile lifestyle, while Indonesian graduates' preference for desktops may indicate a need for stable, extensive computing resources, highlighting different approaches to digital engagement (Khan et al., 2022). Limited internet access, as discussed by Maya and Suseno (2022), presents a barrier to fully utilizing online resources, emphasizing the importance of improving digital infrastructure for equitable access. This limitation is critical in understanding the challenges faced by graduates in both countries in leveraging digital tools for learning and professional development (Maya & Suseno, 2022).

> *Addressing research question 1: How do university graduates in Malaysia and Indonesia compare in terms of their digital literacy and proficiency in 21st-century skills (Collaboration, Critical Thinking, Communication, and Creativity)?*

University graduates in Malaysia and Indonesia show strong digital literacy and 21st-century skills, with slight differences in proficiency levels. Malaysian graduates demonstrate a strong self-perception in evaluating reasoning and evidence, while Indonesian graduates excel in applying knowledge across contexts. Both groups show high self-assessment in collaboration skills, particularly in interpersonal communication and respect, but indicate less confidence in resolving conflicts independently. Khan et al. (2022) emphasize the need for digitally literate employees for sustainable growth, highlighting that digital literacy can improve both academic performance and employability. Saenab et al. (2022) point out the medium-level digital literacy skills among preservice science teachers in Indonesia, suggesting room for improvement. Maya and Suseno (2022) found that most Master of English Language Education students possess a high level of digital literacy and 21st-century skills, although some report lower levels, underscoring the importance of enhancing engagement with technology.

Addressing research question 2: What is the role and significance of Collaboration, Critical Thinking, Communication, and Creativity in shaping digital literacy among university graduates in these countries?

Collaboration, Critical Thinking, Communication, and Creativity play a vital role in shaping digital literacy among graduates. These skills facilitate effective teamwork, problem-solving, clear and effective communication, and innovative thinking. Berlian et al. (2021) use qualitative and quantitative data to assess student readiness to perform 21st-century skills, including digital literacy and productivity. Haviz and Maris (2020) measure Islamic university mathematics and science teachers' perceptions of thinking and acting in 21st-century learning, indicating the significance of problem-solving, creativity, and technology literacy. Digital literacy skills can be enhanced through specific web-centric course designs Utomo et al. (2021).

Addressing research question 3: Are there any notable differences in the impact of these skills on digital literacy between Malaysian and Indonesian graduates?

There are notable differences in the impact of these skills on digital literacy between the two countries. Collaboration skills significantly differ from expected levels of digital literacy, suggesting a cultural or educational emphasis on teamwork. Suherman et al. (2020) highlight the improvement of community digital literacy skills in managing e-resources. Shuhidan et al. (2022) explore the influence of digital literacy on student learning engagement, indicating good digital literacy among students. Tohara et al. (2021) discuss digital literacy strategies for students with special educational needs from teachers' perspectives, emphasizing cognitive skills, technology, and ethics.

6.0 CONCLUSION

In terms of 21st-century skills, the research reveals a strong foundation among graduates in collaboration, critical thinking, communication, and creativity. Collaboration skills, highly rated by graduates, indicate effective teamwork and respect for diverse perspectives. Yet, the reliance on external guidance for conflict resolution, as highlighted by Saenab et al. (2022), points to a need for further development in autonomous problem-solving within collaborative settings.

Critical thinking skills are confidently reported by graduates, with a focus on evaluating evidence and applying knowledge across contexts. However, the variability in self-assessment,

especially among Indonesian respondents, suggests the need for educational strategies to enhance inquiry-based learning and critical questioning techniques. This is supported by the work of Haviz and Maris (2020), who measured perceptions on thinking and acting in 21st-century learning among Islamic university mathematics and science teachers, underscoring the importance of problem-solving and creativity (Haviz & Maris, 2020).

Communication and creativity also emerge as strong points for graduates, with a particular emphasis on using media effectively and adopting appropriate styles for different audiences. The need for improvement in verbal communication skills across both countries highlights a potential area for educational focus. The creativity scores, reflecting confidence in using imagination and elaborating on ideas, indicate an opportunity for curricula to foster innovation and project design skills.

The comparison between Malaysian and Indonesian graduates shows shared strengths and distinct challenges in digital literacy and 21st-century skills. This analysis, grounded in the findings of Tohara et al. (2021) on digital literacy strategies for students with special educational needs, emphasizes the necessity for tailored educational and infrastructural development approaches.

In conclusion, the evidence suggests a pressing need for ongoing investments in digital infrastructure, technology access, and educational programs that prioritize autonomous problem-solving, effective communication, and innovative thinking. Such efforts are essential for preparing Malaysian and Indonesian graduates for a successful transition into the digital and global workforce, contributing to the broader objective of fostering an innovative, adaptable, and digitally fluent society.

One limitation of the study is the lack of consideration for regional and geographic divides, particularly in terms of access to technology in both Malaysia and Indonesia. While the survey included participants from various faculties, no explicit attention was given to whether respondents were from urban or rural areas. Differences in internet access and digital resources between urban and rural settings may influence digital literacy skills. Future research should consider such regional disparities, as they could significantly affect the findings related to digital literacy and 21st-century skill development.

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