The Effect Of Cognitive Competency On Early Adolescent Digital Literation Skills

Pratiwi Kartika Sari[1], Nurudin Siraj[2], Nadia Fatmalia[3]
[1,3]Faculty of Education, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia
[2]Faculty of Social and Polotical Sciences, Universitas Swadaya Gunung Jati, Cirebon , Indonesia
KH. Ahmad Dahlan Street Cirendeu-Ciputat, South Tangerang, 15419
tiwikartika01@gmail.com, nurudin.siraj@ugj.ac.id, fatmalianadia@gmail.com

Accepted:	Reviewed:	Published:
Jan 28th 2025	March 18th 2025	May 30th 2025

Abstract :
This study aims to see the effect of cognitive competency levels C1-Knowledge, C2-Comprehension, and C3-Application on digital literacy skills in early adolescents. In this study cognitive competence is limited to three aspects, such as knowledge, understanding, and application. The research method used a survey by looking at the effect using simple regression analysis. The results showed that the cognitive competency level of knowledge in digital literacy skills was in the top position of 97.0%, the level of application cognitive competence in digital literacy skills was in the second position of 89.0%, the level of cognitive competence in understanding digital literacy skills was in the third position of 80. , 3%. The conclusion in this study is that there is an effect of cognitive competence on digital literacy skills of early adolescents with a knowledge level of C1-Knowledge 97.0% It shows the concept of students' digital literacy skills in remembering and storing information very well, understanding C2-Understanding 80.3% Shows the concept of students 'digital literacy skills in understanding and choosing information well, C3-Application 89.0% Shows the concept of students' digital literacy skills in applying (using) information well.

Keywords : Cognitive competence, digital literacy skills, google

Introduction

In the 21st century revolution, it is famous for industry 4.0. with the trend of the technological revolution or digital revolution. Briefly interpreting industry 4.0 is combining automatic technology with cyber technology [1].

The characteristics of the 4.0 industrial revolution include digitization, optimization and customization of production, automation and adaptation, human machine interaction, value added

[1] Syamsuar Syamsuar and Reflianto Reflianto, "Pendidikan Dan Tantangan Pembelajaran Berbasis Teknologi Informasi Di Era Revolusi Industri 4.0," *E-Tech: Jurnal Ilmiah Teknologi Pendidikan* 6, no. 2 (2019).

services and businesses, automatic data exchange and communication, and integrating the use of internet technology[2]

Internet technology such as the google search engine, youtube, and social media (facebook, instagram, whatsapp) has entered media convergence where there is media integration which makes media use more sophisticated and easy[3].

It was the emergence of the internet that triggered an explosion of information. The openness of information in the rapid development of technology means that messages can be delivered quickly in seconds, an information can be distributed directly throughout the world.

The Ministry of Communication and Information, in an international seminar stated that the use of digital media among children and adolescents in Indonesia, also stated that from the research conducted on children and adolescents aged 10-19 years, there were at least 30 million Indonesian children and adolescents. using the internet and making digital media their main choice of communication channels.

Based on the results of a survey conducted by the European Union Kids Online and published by the European Commission's Safer Internet Program, it is stated that the highest activities carried out by children and adolescents are: School assignments (92%), Playing games (83%), Seeing video clips (75%), Social networks (71%).

APJII (2016) stated that the student group numbered 8.3 million people (6.3%). This data shows that as many as 6.3% of students use the internet. This number is not a small number considering that not all students have sufficient competence in using digital media.

Then came the term digital literacy skills or also known as digital information literacy. In general, literacy is the ability to read, write and listen using conventional media such as books, newspapers, magazines, television and radio. Then the rapid development of technology and information shifts the existence of conventional media to digital media, so literacy develops into digital literacy.

Digital literacy or also known as digital information literacy is the skill of reading, writing and listening using digital media to seek information knowledge. (Masitoh, 2018) (Ferrés & Masanet, 2018) states that if it is related to learning, digital media that is often used by students, especially early adolescents, is the Google search engine, through the Google search engine, early adolescents can read and listen to the knowledge of information obtained to increase knowledge of information. Regarding learning, the Google search engine digital media can help optimize the quality of early adolescent information knowledge. Knowledge to obtain information in early adolescents aged 11-12 years enters the concrete operational stage, Piaget stated that this concrete operational stage is characterized by the development of a system of thought based on logical rules.

These concrete skills refer to the ability to use tools starting from perception, readiness, imitation, real, can be seen and heard, at this concrete operational stage it can be seen that early adolescent digital literacy skills in using digital media to seek information knowledge, to the stage of presenting, preparing , imitating what is seen and heard in searching for knowledge of information on digital media without considering critically the good and bad knowledge of the information for consumption.

---

[2] Iswan Iswan and Herwina Bahar, "Penguatan Pendidikan Karakter Perspektif Islam Dalam Era Millenial IR. 4.0," in *Prosiding Seminar Nasional Pendidikan*, vol. 1, 2018.

[3] Qory Qurratun A'yuni, "Literasi Digital Remaja Di Kota Surabaya: Studi Deskriptif Tentang Tingkat Kompetensi Literasi Digital Pada Remaja Smp, Sma Dan Mahasiswa Di Kota Surabaya" (UNIVERSITAS AIRLANGGA, 2015).

In this study, the author aims to determine the effect of cognitive competence on digital literacy skills of early adolescents, and the levels of cognitive competence C1, C2, and C3 which are the highest and affect digital literacy skills. The reason the researchers conducted this research was due to the rapid access to the internet among students and not all students had sufficient competence in using digital media. In previous research, digital literacy was carried out at the level of adolescent digital literacy competence in the city of Surabaya based on aspects of internet search, hypertext guidance, evaluation of information content and preparation of knowledge.

The solution to the problems raised in this study can be solved by the help of the teacher so that early adolescents are told more effective ways to filter information on their use using keywords, and for parents, play a role in accompanying and limiting then checking the list of information search history on early adolescent smart phones. to control usage and direct early adolescents to use an information search engine (google) with appropriate needs, namely related to learning and adding positive insights.

Cognitive Compentency

1. Competence

   competence is a characteristic of the work ability of each individual which includes aspects of knowledge, skills and work attitudes in a job related to performance effectiveness which can be seen from the style of action, behavior and thinking[4]

2. Cognitive Competence

   competence or cognitive ability is the ability of the brain's thinking process to collect knowledge and information through one's own experience by regulating cognitive activities including the use of existing concepts and rules. The cognitive domain involves knowledge and intellectual skills. There are six main categories of cognitive processes, ranging from the simplest to the most complex, that is the cognitive bloom taxonomy (Benyamin, 2011).

Benjamin S Bloom has developed a "taxonomy" for the cognitive domain. Cognitive taxonomy is a method of making a sequence of thoughts from the basic stage towards a higher level of mental activity, with the following six stages:

1) Knowledge (knowledge) is a person's ability to recall (recall) or recognize again about names, terms, ideas, symptoms, formulas and so on, without expecting the ability to use them. This knowledge or memory is the lowest thought process.
2) Comprehension (comprehension) is a person's ability to understand or understand something after something is known and remembered. In other words, understanding is knowing about something and being able to see it from various angles. Students said to understand something if they can provide an explanation or give a more detailed description of it using their own words. Comprehension is a level of thinking ability which is one level higher than memory or memorization.
3) Application is a person's ability to apply or use general ideas, procedures or methods, principles, formulas, theories and so on, in new and concrete situations. This application or application is a thought process at a higher level of understanding.

[4] Michael Eraut, "Concepts of Competence," *Journal of Interprofessional Care* 12, no. 2 (1998): 127–139, http://dx.doi.org/10.3109/13561829809014100; Françoise Delamare Le Deist and Jonathan Winterton, "What Is Competence?," *Human Resource Development International* 8, no. 1 (2005): 27–46, http://dx.doi.org/10.1080/1367886042000338227.

Digital Literacy Skills

1. Literacy

literacy is the ability to read and write then develop along with the rapid development of technology into multiliteration where multiliteration is the skill of using various ways to express and understand information using symbols and multimedia forms on digital devices [5] .

After a general introduction to the basic concept of 'literacy', which has been expanded to include newer forms of literacy, it is more suitable for complex information environments. Some of them, for example libraries, media and computer literature, are mostly based on general concept skills, such as information literacy and digital literacy which are based on knowledge of digital literacy skills [6]

2. Digital Literacy Skills

Digital literacy can be defined as literacy or the ability to read, write and listen to text with the ability to use digital [7].

Another opinion states that digital literacy skills are not only the ability to read and write but the ability to listen, read, see, speak, write, create and reflect increasingly complex and sophisticated information by combining writing and speech in an informational text [8]. Digital literacy is very important to increase effectiveness or more efficient performance in learning digital literacy skills (Emerald Group Publishing Limitied, 2010) [9].

Digital literacy skills can link critical literacy to digital use activities so that students are ready to interact in the global world in using digital tools to find information outside academics [10].

---

[5] Pirjo Kulju et al., "A Review of Multiliteracies Pedagogy in Primary Classrooms," *Language and Literacy* 20, no. 2 (2018): 80–101, http://dx.doi.org/10.20360/langandlit29333; Robyn Henderson, "Classroom Pedagogies, Digital Literacies and the Home-School Digital Divide," *International Journal of Pedagogies and Learning* 6, no. 2 (2011): 152–161, http://dx.doi.org/10.5172/ijpl.2011.152.

[6] David Bawden, "Information and Digital Literacies: A Review of Concepts," *Journal of Documentation* 57, no. 2 (2001): 218–259, http://dx.doi.org/10.1108/eum0000000007083.

[7] Michelle M Neumann, Glenn Finger, and David L Neumann, "A Conceptual Framework for Emergent Digital Literacy," *Early Childhood Education Journal* 45, no. 4 (2016): 471–479, http://dx.doi.org/10.1007/s10643-016-0792-z; David C Caverly et al., "Identifying Digital Literacies to Build Academic Literacies," *Journal of College Reading and Learning* 49, no. 3 (2019): 170–205, http://dx.doi.org/10.1080/10790195.2019.1638218; Julian McDougall, Mark Readman, and Philip Wilkinson, "The Uses of (Digital) Literacy," *Learning, Media and Technology* 43, no. 3 (2018): 263–279, http://dx.doi.org/10.1080/17439884.2018.1462206; Julian McDougall et al., "Digital Literacy, Fake News and Education / Alfabetización Digital, Fake News y Educación," *Cultura y Educación* 31, no. 2 (2019): 203–212, http://dx.doi.org/10.1080/11356405.2019.1603632.

[8] Maureen Walsh, "Multiliteracies, Multimodality, New Literacies and …. What Do These Mean for Literacy Education?," *International Perspectives on Inclusive Education* (Emerald Publishing Limited, 2017), http://dx.doi.org/10.1108/s1479-363620170000011002.

[9] Sedat Akayoglu et al., "Digital Literacy Practices of Turkish Pre-Service EFL Teachers," *Australasian Journal of Educational Technology* (2020), http://dx.doi.org/10.14742/ajet.4711; Walsh, "Multiliteracies, Multimodality, New Literacies and …. What Do These Mean for Literacy Education?"; *The Meanings of Dress*, *The Meanings of Dress*, 2019; Irena Y Maureen, Hans van der Meij, and Ton de Jong, "Supporting Literacy and Digital Literacy Development in Early Childhood Education Using Storytelling Activities," *International Journal of Early Childhood* 50, no. 3 (2018): 371–389, http://dx.doi.org/10.1007/s13158-018-0230-z; Neumann, Finger, and Neumann, "A Conceptual Framework for Emergent Digital Literacy."

[10] Natalie Amgott, "Critical Literacy in #DigitalActivism: Collaborative Choice and Action," *The International Journal of Information and Learning Technology* 35, no. 5 (2018): 329–341, http://dx.doi.org/10.1108/ijilt-05-2018-0060; Michele Garabedian Stork et al., "Embracing the Power of Digital in Literacy Education: Evaluating the Effectiveness of Digital Activities," *Journal of Formative Design in Learning* 2, no. 2 (2018): 82–101, http://dx.doi.org/10.1007/s41686-018-0022-8; Akayoglu et al., "Digital Literacy Practices of Turkish Pre-Service EFL Teachers"; Katherine Cook et al., "Teaching Open Science: Published Data and Digital Literacy in Archaeology Classrooms," *Advances in Archaeological Practice* 6, no. 2 (2018): 144–156, http://dx.doi.org/10.1017/aap.2018.5.

Digital literacy is used in education, where elementary school students, especially early adolescents, use digital to foster meaningful experiences with all students in all environments in seeking information both in the scope of school, class, and home [11].

Opportunities to teach and learn with new literacy help early adolescents bridge technical skill gaps, and benefit social relationships in digital communities and bridge digital literacy experiences for elementary students to be more critical of existing information within the school environment and outside of school [12]. So to present the necessary skills the concept of digital literacy skills put forward [13] concerns the following aspects:

a. Knowledge assembly, that is the ability to build information from various reliable sources.
b. The ability to present information including critical thinking in understanding information with awareness of the validity and completeness of sources from the internet
c. Ability to read and understand non-sequential and dynamic information material
d. Awareness of the importance of conventional media and linking it to networked media (internet)
e. Awareness of access to networks of people who can be used as a source of referrals and help
f. Use filters for incoming information
g. Feel comfortable and have access to communicate and publish information.

If you look at the opinion of Bawden[14] above, digital literacy is more associated with technical skills in accessing, arranging, disseminating information.

Method

This study utilized a survey research design to explore the digital literacy skills of early adolescents, specifically focusing on the cognitive competence levels of grade V students. The study was conducted in three elementary schools in the Pondok Betung area, namely SDN Pondok Betung 01, SDN Pondok Betung 02, and SDN Pondok Betung 04. A simple random sampling technique was employed to select the participants, ensuring that every student in the targeted population had an equal chance of being included in the study.

Participants

The study targeted 125 grade V elementary school students from the three selected schools. These students were aged between 11 and 12 years old, representing the early adolescent group. The sample size was chosen to ensure a sufficient number of participants to achieve

[11] Chrystine Mitchell and Jennifer Dandridge Turner, "Only One IPad: Preparing Pre-Service Teachers to Teach Digital Literacies in Under-Resourced Elementary Schools," *Best Practices in Teaching Digital Literacies* (Emerald Publishing Limited, 2018), http://dx.doi.org/10.1108/s2048-045820180000009004; Caverly et al., "Identifying Digital Literacies to Build Academic Literacies"; McDougall et al., "Digital Literacy, Fake News and Education / Alfabetización Digital, Fake News y Educación"; Nisaul Barokati Seliro Wangi, M Hafidh Nashrullah, and Muh Barid Nizarudin Wajdi, "Digital Era's Education and Aplication in Higher Education," *EDUTEC: Journal of Education And Technology* 1, no. 2 (2018): 119–128.

[12] Jessica S Mitchell, Rachael F Thompson, and Rebecca S Anderson, "Understanding a Digital Writing Cycle: Barriers, Bridges, and Outcomes in Two Second-Grade Classrooms," *Literacy Research, Practice and Evaluation* (Emerald Group Publishing Limited, 2016), http://dx.doi.org/10.1108/s2048-045820160000007009; Joy Myers and Melissa Adams-Budde, "Teaching Literacy in the Digital Age: Inspiration for All Levels and Literacies," *International Review of Education* 63, no. 5 (2017): 769–772, http://dx.doi.org/10.1007/s11159-017-9649-y; Neumann, Finger, and Neumann, "A Conceptual Framework for Emergent Digital Literacy."

[13] Bawden, "Information and Digital Literacies: A Review of Concepts."

[14] Ibid.

statistically meaningful results while maintaining practicality in terms of data collection. Simple random sampling was used to select participants, where the researchers assigned a number to each student, written in two different colors (red and black). The numbers were shuffled, and students randomly selected one of the numbers to determine their inclusion in the sample. This method helped eliminate any bias in the selection process, providing a representative sample of the student population.

Data Collection Methods

Data were collected through the administration of a questionnaire, which was designed to assess the students' digital literacy skills and cognitive competence levels. The questionnaire consisted of multiple-choice questions and Likert-scale items, focusing on students' ability to use digital tools for information retrieval, critical thinking skills, and their general approach to using digital media for educational purposes. The questionnaire was divided into two main sections:

1. Digital Literacy Skills: This section assessed the students' proficiency in using digital media for academic purposes, including searching for information, evaluating sources, and integrating knowledge from digital platforms.
2. Cognitive Competence: Based on Bloom's Taxonomy (Benyamin, 2011), this section evaluated the students' cognitive abilities across three levels—C1 (Knowledge), C2 (Comprehension), and C3 (Application). These levels correspond to the students' capacity to recall, understand, and apply knowledge, respectively.

The questionnaires were distributed to the selected students, and they were instructed to complete them under the supervision of the researchers. The data collection process was conducted over a period of two weeks, ensuring ample time for students to respond thoughtfully to the questions.

Data Analysis Procedures

The data collected from the questionnaires were analyzed using both descriptive statistics and inferential statistics to explore the relationship between cognitive competence and digital literacy skills. The analysis followed these steps:

1. Data Cleaning: The responses from the questionnaires were reviewed to ensure completeness and accuracy. Any incomplete or inconsistent responses were excluded from the final dataset.
2. Descriptive Statistics: Basic statistical measures such as frequency distributions, mean scores, and standard deviations were computed to summarize the students' responses on both digital literacy skills and cognitive competence levels.
3. Inferential Statistics: To assess the relationship between cognitive competence and digital literacy skills, correlation analysis was performed. This method allowed the researchers to examine whether higher cognitive competence (specifically C1, C2, and C3 levels) was associated with better digital literacy skills. Regression analysis was also employed to predict the extent to which cognitive competence influences digital literacy proficiency.

The results of the data analysis were presented in tables and graphs to provide a clear visualization of the relationships and trends identified. The analysis was performed using SPSS (Statistical Package for the Social Sciences) software, which is widely used in educational research for its ability to perform complex statistical procedures efficiently.

Limitations of the Study

Several limitations must be acknowledged in this study. First, the sample size of 125 students, while adequate for a preliminary study, may not fully represent the broader population of early adolescents across the country. As the study was conducted in only three schools in the Pondok Betung area, the findings may not be generalizable to other regions with different socio-economic backgrounds or educational systems. Additionally, since the data were collected using self-reported questionnaires, there is a potential for response bias, as students may have overestimated or underestimated their digital literacy skills.

Another limitation is that the study only focused on students' self-reported abilities to use digital media. Future research could incorporate more direct assessments of students' digital literacy skills, such as practical tasks or performance-based tests, to provide a more accurate picture of their capabilities.

Reliability and Validity

To ensure the reliability and validity of the instruments used in this study, the questionnaire was pre-tested on a small group of students who were not part of the main study sample. The results of the pre-test were used to refine the wording and structure of the questions, ensuring clarity and relevance. The Cronbach's alpha coefficient was calculated to assess the internal consistency of the questionnaire, with a value above 0.70 indicating acceptable reliability (Tavakol & Dennick, 2011).

Additionally, face validity and content validity were established by consulting with experts in digital literacy and cognitive development. These experts reviewed the questionnaire to ensure that it accurately measured the intended constructs—digital literacy skills and cognitive competence—based on established frameworks.

Result and Discussion

Based on the research findings, the cognitive competency levels of C1, C2, and C3 that have the most influence on digital literacy skills can be seen in the following percentage diagram:

Illustrations

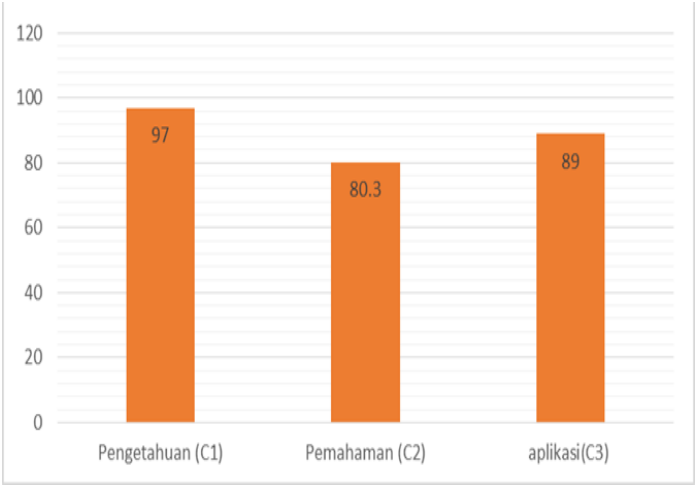

Fig 1. (a) Percentage of Competency / Cognitive Ability Bar Charts on Digital Literacy Skills

The level of cognitive competence towards early adolescent digital literacy skills with a knowledge level of C1 of 97.0% at this stage shows the concept of digital literacy skills of early adolescents in remembering and storing information is very good, understanding C2 is 80.3%, this stage shows the concept of digital literacy skills Early adolescents understand and choose good information, the C3 application is 89.0%, indicating that the concept of early adolescent digital literacy skills in the application (use) of information is quite good

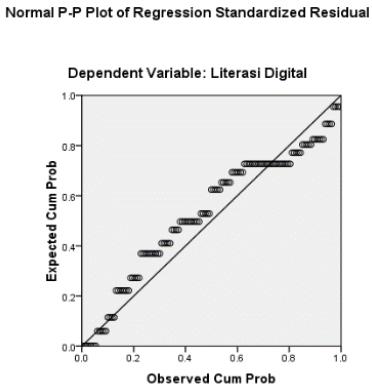

Fig 2. (b) simple regression curve

Table 1 Reliability Test and Prerequisite Analysis of the Effect of Cognitive Competence on Digital Literacy Skills

Reliability> 0.7	**Normality Sig> 0.05 (Normal)**	**Homogeneity Sig> 0.05 (Homogeneous)**	**Simple Regression**
The result of the reliability test on the effect of cognitive competence on digital literacy skills in early adolescents is 0.754	The results of the normality test using Kolmogorov Smirnov obtained results 0.11 significance value> 0.05 so that 0.11> 0.05, it can be concluded that the residual value is normally distributed	The results of the normality test using the levene test resulted in a significant value of 0.76> 0.05 so that 0.76> 0.05, it was concluded that all variables were homogeneous.	Based on the significance value of the coefficients table, it is obtained a significance value of 0.000 less than 0.05 (0,000 <0.05) so it can be concluded that the cognitive competency variable (X) affects digital literacy skills (Y). The correlation value / relationship (R) is 0.990. From this output, the coefficient of determination (R square) is 0.979.

Discussion

The results of this study provide compelling evidence that cognitive competence levels (C1, C2, and C3) play a significant role in shaping the digital literacy skills of early adolescents. The data revealed that cognitive competencies, particularly at the levels of knowledge (C1), comprehension (C2), and application (C3), have a substantial impact on students' abilities to engage with digital media effectively. This discussion will analyze these findings in comparison to existing literature, integrating the cognitive development theory and digital literacy frameworks to provide a deeper understanding of the implications for educational practice and future research.

Cognitive Competence and Digital Literacy Skills

The findings of this study align with Bloom's Taxonomy of cognitive development, which classifies cognitive processes from simple recall of facts (C1) to more complex processes like comprehension (C2) and application (C3) (Bloom, 1956). In the context of digital literacy, early adolescents demonstrated strong performance in C1 (Knowledge), with a high percentage of 97.0% indicating that they excel at remembering and storing information from digital media. This result is consistent with previous research that highlights the importance of foundational knowledge in digital literacy [15]. The strong performance at this stage suggests that early adolescents have a solid grasp of basic information retrieval processes, a critical skill for navigating digital platforms effectively.

However, while the students performed excellently at C1, the C2 (Comprehension) level revealed a slightly lower percentage of 80.3%, indicating that while students can understand and choose appropriate information, they may struggle to fully grasp the nuances of digital content. This finding resonates with studies by Ferrés & Masanet [16], who argue that comprehension of digital information involves more than just retrieving data—it requires the ability to critically assess and interpret digital content. The performance at this level reflects a developing capacity for critical thinking, which is essential in a digitally saturated world where the volume of information can be overwhelming.

The C3 (Application) level showed a solid percentage of 89.0%, signifying that students are fairly proficient in applying the information they have learned through digital media in practical contexts. This aligns with the view by Henderson [17], who suggests that digital literacy involves not only the ability to access information but also the capability to use that information effectively in real-world scenarios. These results suggest that while early adolescents can apply digital knowledge in specific contexts, further development of critical thinking and decision-making skills is necessary to ensure that they use digital tools ethically and responsibly.

Cognitive Competence and Digital Literacy: Regression Analysis

The simple regression analysis conducted on the data revealed a significant relationship between cognitive competence and digital literacy skills. The correlation value (R) of 0.990 is

[15] Siti Masitoh, "Blended Learning Berwawasan Literasi Digital Suatu Upaya Meningkatkan Kualitas Pembelajaran Dan Membangun Generasi Emas 2045," *Proceedings of the ICECRS* 1, no. 3 (2018), http://dx.doi.org/10.21070/picecrs.v1i3.1377; Neumann, Finger, and Neumann, "A Conceptual Framework for Emergent Digital Literacy."

[16] Joan Ferrés, Maria-Jose Masanet, and Julio-César Mateus, "Three Paradoxes in the Approach to Educational Technology in the Education Studies of the Spanish Universities," *International Journal of Educational Technology in Higher Education* 15, no. 1 (2018), http://dx.doi.org/10.1186/s41239-018-0097-y.

[17] Henderson, "Classroom Pedagogies, Digital Literacies and the Home-School Digital Divide."

exceptionally high, suggesting a near-perfect positive relationship between the two variables. This is further supported by the coefficient of determination (R square) value of 0.979, which indicates that cognitive competence accounts for nearly 98% of the variance in digital literacy skills. These findings are consistent with McDougall et al. [18], who emphasize that cognitive abilities, particularly comprehension and application, are crucial for developing robust digital literacy skills. The strong statistical relationship indicates that as cognitive competence improves, so too do the digital literacy skills of early adolescents.

The reliability test score of 0.754 confirms that the instrument used to measure cognitive competence and digital literacy was reliable, with an acceptable level of internal consistency [19]. Additionally, the normality and homogeneity tests confirmed that the data were suitable for regression analysis, as evidenced by the significance values ($p > 0.05$) obtained for the Kolmogorov-Smirnov test and Levene's test. These results validate the robustness of the analysis and the applicability of the findings to the broader context of early adolescent education.

Implications for Practice

The findings from this study have significant implications for educational practice, particularly in the development of digital literacy curricula. Since cognitive competence, especially at the C1, C2, and C3 levels, plays a pivotal role in enhancing digital literacy skills, educators should focus on fostering these competencies in early adolescents. Specifically, educators should create learning environments that not only encourage the retrieval of digital information but also promote critical thinking and the application of knowledge in practical contexts.

For instance, teacher-guided activities could be designed to help students move beyond basic information retrieval and engage in tasks that challenge them to critically analyze digital content. These activities could involve problem-solving tasks, digital storytelling, or online research projects, which require students to apply their cognitive skills in a real-world digital context. This approach aligns with the ideas presented by Bawden [20], who suggests that digital literacy should involve not only technical skills but also critical thinking and problem-solving capabilities.

Additionally, the findings highlight the importance of fostering collaborative learning environments, where students can interact with peers to share ideas and evaluate digital information together. This approach can help enhance comprehension (C2) and application (C3) skills, encouraging students to move from passive consumers of information to active participants in the digital world.

While the findings of this study are promising, several limitations should be considered. The sample size of 125 students, though adequate for preliminary analysis, may not be representative of the broader population of early adolescents. Future research could expand the sample to include students from different geographical locations or socio-economic backgrounds to examine whether the relationship between cognitive competence and digital literacy skills holds across diverse contexts.

Moreover, future studies could explore the impact of specific teaching interventions aimed at enhancing C2 (Comprehension) and C3 (Application) levels, as these competencies showed

[18] McDougall, Readman, and Wilkinson, "The Uses of (Digital) Literacy."

[19] M Tavakol and R Dennick, "Making Sense of Cronbach's Alpha," *International journal of medical education* 2 (2011): 53–55, https://www.scopus.com/inward/record.uri?eid=2-s2.0-85028506646&doi=10.5116%2Fijme.4dfb.8dfd&partnerID=40&md5=3b6332006bbf40a020e7428acf849533.

[20] Bawden, "Information and Digital Literacies: A Review of Concepts."

slightly lower performance compared to C1 (Knowledge). Experimental studies that compare students who receive targeted instruction in these areas with a control group would provide valuable insights into effective teaching strategies for enhancing digital literacy.

In addition, future research could investigate the long-term impact of digital literacy on students' academic performance and social engagement. Given the growing importance of digital literacy in the modern world, it would be valuable to explore how early digital literacy skills influence students' ability to succeed in higher education and their preparedness for the workforce.

This study demonstrates that cognitive competence—particularly in the areas of knowledge recall, comprehension, and application—significantly impacts the digital literacy skills of early adolescents. The results suggest that educators must focus on enhancing these cognitive competencies to help students navigate and critically engage with the vast amounts of information available on digital platforms. As digital literacy continues to be a critical skill for success in the 21st century, educational systems must prioritize its development, ensuring that students are equipped with both the technical and critical thinking skills needed to thrive in an increasingly digital world.

Conclusion

The findings of this study underscore the critical role of cognitive competence in shaping digital literacy skills among early adolescents. The analysis reveals a statistically significant relationship between cognitive competencies (C1, C2, C3) and digital literacy skills, with a significance value of 0.000 ($p < 0.05$), demonstrating that cognitive competence significantly influences students' abilities to engage with and utilize digital media effectively. This relationship suggests that as students' cognitive abilities in knowledge, comprehension, and application improve, so too does their proficiency in navigating and critically assessing digital content.

Furthermore, the R Square value of 97.9% indicates that cognitive competence accounts for a large proportion of the variance in digital literacy skills, highlighting the importance of fostering cognitive development in early adolescents to enhance their digital literacy. This strong effect aligns with existing research which emphasizes the interconnectedness of cognitive development and digital literacy . These results suggest that interventions aimed at improving cognitive skills, especially at the foundational knowledge (C1) level, can significantly boost students' ability to use digital media for learning and personal growth.

Among the cognitive competencies, C1 (Knowledge) was found to have the most profound effect on digital literacy skills, with an R Square value of 97.0%. This indicates that students who excel in recalling and understanding information from digital platforms are better positioned to develop strong digital literacy skills. The finding aligns with Bloom's Taxonomy (Bloom, 1956), where foundational knowledge serves as the building block for higher cognitive processes such as comprehension and application. This suggests that educational strategies focusing on enhancing memory recall and understanding could be pivotal in fostering effective digital literacy skills in early adolescents.

These findings have important implications for both educators and policymakers. Firstly, educators should focus on enhancing the C1 (Knowledge) level of cognitive competence among early adolescents, as it significantly contributes to the development of digital literacy skills. Teachers can implement strategies that promote active learning, information retrieval, and knowledge organization, which are essential for improving students' ability to engage with digital content. Incorporating more interactive digital tools and resources into the curriculum can also

help students strengthen their foundational knowledge and develop a deeper understanding of how to use digital media effectively.

Additionally, schools should prioritize critical thinking and information evaluation within digital literacy curricula, ensuring that students are not only adept at accessing information but also capable of assessing its credibility and relevance. As digital media becomes increasingly prevalent, it is crucial to equip students with the skills necessary to navigate the complexities of the digital world.

Future research could further investigate the longitudinal impact of cognitive competence on digital literacy, exploring how cognitive development at different stages of education influences students' ability to engage with digital media over time. Additionally, studies could examine how specific teaching interventions targeting cognitive competence (such as memory-enhancement techniques or critical thinking exercises) impact digital literacy skills in diverse student populations. Research could also extend the findings of this study by exploring the role of socio-economic factors and cultural contexts in shaping digital literacy, particularly in regions with varying access to technology.

Finally, while this study highlights the importance of cognitive competence in digital literacy, future studies might explore multidimensional approaches to digital literacy, including emotional intelligence, social media literacy, and ethical considerations in digital engagement. This would provide a more comprehensive understanding of the skills necessary for effective digital participation and create a more holistic framework for educating digitally literate citizens.

The study underscores the significant role of cognitive competence, particularly C1 (Knowledge), in enhancing digital literacy skills among early adolescents. By fostering cognitive skills in the areas of knowledge recall and comprehension, educators can help students navigate and critically engage with the digital world. As digital media continues to evolve, it is essential to integrate these findings into educational practices and policies to ensure that students are equipped with the necessary skills to succeed in an increasingly digital society.

References

A'yuni, Qory Qurratun. "Literasi Digital Remaja Di Kota Surabaya: Studi Deskriptif Tentang Tingkat Kompetensi Literasi Digital Pada Remaja Smp, Sma Dan Mahasiswa Di Kota Surabaya." UNIVERSITAS AIRLANGGA, 2015.

Akayoglu, Sedat, H Müge Satar, Kenan Dikilitas, Nazlı Ceren Cirit, and Sibel Korkmazgil. "Digital Literacy Practices of Turkish Pre-Service EFL Teachers." *Australasian Journal of Educational Technology* (2020). http://dx.doi.org/10.14742/ajet.4711.

Amgott, Natalie. "Critical Literacy in #DigitalActivism: Collaborative Choice and Action." *The International Journal of Information and Learning Technology* 35, no. 5 (2018): 329–341. http://dx.doi.org/10.1108/ijilt-05-2018-0060.

Bawden, David. "Information and Digital Literacies: A Review of Concepts." *Journal of Documentation* 57, no. 2 (2001): 218–259. http://dx.doi.org/10.1108/eum0000000007083.

Caverly, David C, Emily M Payne, Amarilis M Castillo, Amber Sarker, Elizabeth Threadgill, and Daniel West. "Identifying Digital Literacies to Build Academic Literacies." *Journal of College Reading and Learning* 49, no. 3 (2019): 170–205. http://dx.doi.org/10.1080/10790195.2019.1638218.

Cook, Katherine, Canan Çakirlar, Timothy Goddard, Robert Carl DeMuth, and Joshua Wells. "Teaching Open Science: Published Data and Digital Literacy in Archaeology Classrooms." *Advances in Archaeological Practice* 6, no. 2 (2018): 144–156. http://dx.doi.org/10.1017/aap.2018.5.

Le Deist, Françoise Delamare, and Jonathan Winterton. "What Is Competence?" *Human Resource Development International* 8, no. 1 (2005): 27–46. http://dx.doi.org/10.1080/1367886042000338227.

Eraut, Michael. "Concepts of Competence." *Journal of Interprofessional Care* 12, no. 2 (1998): 127–139. http://dx.doi.org/10.3109/13561829809014100.

Ferrés, Joan, Maria-Jose Masanet, and Julio-César Mateus. "Three Paradoxes in the Approach to Educational Technology in the Education Studies of the Spanish Universities." *International Journal of Educational Technology in Higher Education* 15, no. 1 (2018). http://dx.doi.org/10.1186/s41239-018-0097-y.

Henderson, Robyn. "Classroom Pedagogies, Digital Literacies and the Home-School Digital Divide." *International Journal of Pedagogies and Learning* 6, no. 2 (2011): 152–161. http://dx.doi.org/10.5172/ijpl.2011.152.

Iswan, Iswan, and Herwina Bahar. "Penguatan Pendidikan Karakter Perspektif Islam Dalam Era Millenial IR. 4.0." In *Prosiding Seminar Nasional Pendidikan*. Vol. 1, 2018.

Kulju, Pirjo, Reijo Kupiainen, Angela M Wiseman, Anne Jyrkiäinen, Kirsi-Liisa Koskinen-Sinisalo, and Marita Mäkinen. "A Review of Multiliteracies Pedagogy in Primary Classrooms." *Language and Literacy* 20, no. 2 (2018): 80–101. http://dx.doi.org/10.20360/langandlit29333.

Masitoh, Siti. "Blended Learning Berwawasan Literasi Digital Suatu Upaya Meningkatkan Kualitas Pembelajaran Dan Membangun Generasi Emas 2045." *Proceedings of the ICECRS* 1, no. 3 (2018). http://dx.doi.org/10.21070/picecrs.v1i3.1377.

Maureen, Irena Y, Hans van der Meij, and Ton de Jong. "Supporting Literacy and Digital Literacy Development in Early Childhood Education Using Storytelling Activities." *International Journal of Early Childhood* 50, no. 3 (2018): 371–389. http://dx.doi.org/10.1007/s13158-018-0230-z.

McDougall, Julian, Maria-José Brites, Maria-João Couto, and Catarina Lucas. "Digital Literacy, Fake News and Education / Alfabetización Digital, Fake News y Educación." *Cultura y Educación* 31, no. 2 (2019): 203–212. http://dx.doi.org/10.1080/11356405.2019.1603632.

McDougall, Julian, Mark Readman, and Philip Wilkinson. "The Uses of (Digital) Literacy." *Learning, Media and Technology* 43, no. 3 (2018): 263–279. http://dx.doi.org/10.1080/17439884.2018.1462206.

Mitchell, Chrystine, and Jennifer Dandridge Turner. "Only One IPad: Preparing Pre-Service Teachers to Teach Digital Literacies in Under-Resourced Elementary Schools." *Best Practices in Teaching Digital Literacies*. Emerald Publishing Limited, 2018. http://dx.doi.org/10.1108/s2048-045820180000009004.

Mitchell, Jessica S, Rachael F Thompson, and Rebecca S Anderson. "Understanding a Digital Writing Cycle: Barriers, Bridges, and Outcomes in Two Second-Grade Classrooms." *Literacy Research, Practice and Evaluation*. Emerald Group Publishing Limited, 2016. http://dx.doi.org/10.1108/s2048-045820160000007009.

Myers, Joy, and Melissa Adams-Budde. "Teaching Literacy in the Digital Age: Inspiration for All Levels and Literacies." *International Review of Education* 63, no. 5 (2017): 769–772. http://dx.doi.org/10.1007/s11159-017-9649-y.

Neumann, Michelle M, Glenn Finger, and David L Neumann. "A Conceptual Framework for Emergent Digital Literacy." *Early Childhood Education Journal* 45, no. 4 (2016): 471–479. http://dx.doi.org/10.1007/s10643-016-0792-z.

Stork, Michele Garabedian, Honey Goode, Richard Jeter, and Jingshun Zhang. "Embracing the Power of Digital in Literacy Education: Evaluating the Effectiveness of Digital Activities." *Journal of Formative Design in Learning* 2, no. 2 (2018): 82–101. http://dx.doi.org/10.1007/s41686-018-0022-8.

Syamsuar, Syamsuar, and Reflianto Reflianto. "Pendidikan Dan Tantangan Pembelajaran Berbasis Teknologi Informasi Di Era Revolusi Industri 4.0." *E-Tech: Jurnal Ilmiah Teknologi Pendidikan* 6, no. 2 (2019).

Tavakol, M, and R Dennick. "Making Sense of Cronbach's Alpha." *International journal of medical education* 2 (2011): 53–55. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85028506646&doi=10.5116%2Fijme.4dfb.8dfd&partnerID=40&md5=3b6332006bbf40a020e7428acf849533.

Walsh, Maureen. "Multiliteracies, Multimodality, New Literacies and …. What Do These Mean for Literacy Education?" *International Perspectives on Inclusive Education*. Emerald Publishing Limited, 2017. http://dx.doi.org/10.1108/s1479-363620170000011002.

Wangi, Nisaul Barokati Seliro, M Hafidh Nashrullah, and Muh Barid Nizarudin Wajdi. "Digital Era's Education and Aplication in Higher Education." *EDUTEC: Journal of Education And Technology* 1, no. 2 (2018): 119–128.