

Determinants of University Students' Reading Literacy

The Roles of Digital Literacy, Academic Engagement, and Demographic Factors

¹Muhammad Iqbal*, ²Bambang Robiin, ¹Agus Jayadi, ¹Rila Hardiansyah, ¹Ahmad Muslim

Corresponding Author: *muhammadiqbal@undikma.ac.id

¹ Mandalika University of Education, Mataram, Indonesia

² University of Ahmad Dahlan, Yogyakarta, Indonesia

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ABSTRACT

Reading literacy is a fundamental competency for university students, especially in teacher education programs, as they will later foster literacy skills among future learners. This study examined the determinants of reading literacy among students at the Faculty of Education and Psychology, Mandalika University of Education, Indonesia. A quantitative explanatory survey design was applied, involving 185 students selected through stratified random sampling. Data were gathered using a reading literacy test, a digital literacy questionnaire, and an academic engagement questionnaire, and analyzed through hierarchical multiple regression. The findings showed that demographic variables (gender, GPA, semester, and study program) explained 12.4% of the variance in reading literacy ($p = .001$), with gender and study program as significant predictors. When digital literacy and academic engagement were included, the explained variance increased by 5.5% ($p = .003$), with digital literacy emerging as the strongest predictor ($\beta = .247$, $p = .001$). In contrast, academic engagement was not a significant predictor when other variables were controlled. Moderation analysis indicated that demographic variables did not significantly influence the relationship between digital literacy or academic engagement and reading literacy ($\Delta R^2 = .021$, $p = .615$). These results highlight digital literacy as a key factor in improving reading literacy among teacher education students. Therefore, integrating digital literacy into curricula is essential to enhance students' competencies across diverse backgrounds.

Keywords

Academic Engagement
Demographic Factors
Digital Literacy
Reading Literacy
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Introduction

In the contemporary digital era, reading literacy has become an essential cognitive competency that determines the quality of human resources in navigating the complexities of global information. The Organisation for Economic Co-operation and Development (OECD), through the Programme for International Student Assessment (PISA), consistently emphasizes the importance of reading literacy as a foundation for problem-solving, critical thinking, and evidence-based decision-making [1]. Although technological advancements have expanded access to information, a paradox emerges when such access is not accompanied by improved abilities to understand, evaluate, and effectively utilize information [2]. This situation is particularly critical for university students in teacher education programs, as these students occupy a strategically unique position: their own reading literacy will directly shape the quality of literacy instruction they deliver to future generations of learners. A deficit in reading literacy among pre-service teachers thus risks a cascading negative impact on the broader education system.

The Indonesian national context reflects similar challenges. PISA 2018 results showed that Indonesian students' reading literacy scores remained below the average of participating countries, ranking 72nd out of 77 countries [1]. Additionally, national surveys by the Ministry of Education and Culture's Research Center indicate low reading interest and comprehension among students and university learners [3]. Digital literacy, as a support for modern reading abilities, has also become a critical issue due to the low perception of digital competencies among university students in filtering and understanding online information [4]. These challenges are exacerbated in regions with geographical and socio-economic constraints, such as West Nusa Tenggara Province, where access and reading habits of university students are still influenced by school background, geographical location, and learning patterns formed during primary and secondary education [3].

From a theoretical perspective, digital literacy and academic engagement are conceptually relevant to reading literacy development. Digital literacy encompasses the ability to access, evaluate, and utilize digital information critically [5], which are skills that directly support comprehension of both digital and traditional texts. Academic engagement, understood as students' behavioral, cognitive, and emotional involvement in academic

activities [6], has been linked to various positive learning outcomes including enhanced comprehension skills [7]. The opportunity-propensity framework suggests that both opportunity factors (such as digital access) and propensity factors (including engagement and self-concept) contribute to literacy performance [8]. However, empirical evidence examining the combined effects of these variables on university students' reading literacy, particularly in Indonesian higher education contexts, remains limited.

Previous studies have revealed various dimensions related to digital literacy and reading among university students in Indonesia. Research has found that multiliteracy practices in digital-based reading classes can enhance student engagement and comprehension, although pedagogical integration remains suboptimal [9]. Similarly, the development of multimodal digital teaching materials positively contributes to improving reading literacy [10]. Other studies have identified gender-based differences in digital literacy perceptions and their impact on language skills [11]. Despite these contributions, several critical gaps remain. First, most prior studies have examined digital literacy, academic engagement, and demographic factors in isolation, without integrating them into a unified explanatory model that accounts for their simultaneous and interactive effects on reading literacy. Second, quantitative, performance-based assessments of reading literacy among Indonesian university students are scarce; existing studies tend to rely on self-reported perceptions rather than objective test-based measures. Third, demographic factors such as study program, GPA, and semester have not been extensively examined as variables influencing—or potentially moderating—the effects of digital literacy and academic engagement on reading literacy among teacher education students [12]. This fragmented approach limits both theoretical understanding and the development of evidence-based interventions for literacy improvement in higher education.

This study advances prior research by integrating digital literacy, academic engagement, and demographic factors within a single hierarchical regression model to examine their individual, incremental, and interactive effects on reading literacy. Unlike previous studies that examined these variables separately, the present study employs hierarchical multiple regression to systematically separate the contributions of each variable block—demographic factors, core predictors (digital literacy and academic engagement), and their interaction terms—thereby providing a more comprehensive understanding of the determinants of reading literacy.

The research questions guiding this study are: (1) What is the effect of demographic variables (gender, GPA, semester, and study program) on students' reading literacy? (2) What is the effect of academic engagement and digital literacy on students' reading literacy after controlling for demographic variables? (3) Do demographic variables (gender, GPA, and

semester) moderate the effects of academic engagement and digital literacy on students' reading literacy? The focus on teacher education students is deliberate, as this population serves as the primary vehicle through which literacy competencies are transmitted to future generations; understanding what drives their reading literacy is therefore not only an academic concern but a matter of educational policy urgency. This study contributes to the literature by providing empirical evidence on the relative importance of digital literacy versus academic engagement in predicting reading literacy, while offering practical implications for curriculum development and intervention design in Indonesian teacher education programs.

Material and Methods

A. Research Design

This study employed a quantitative explanatory survey design to examine the effects of digital literacy, academic engagement, and demographic factors on university students' reading literacy. This design was appropriate because the study aimed not only to describe the characteristics of the variables but also to explain the predictive relationships among them [13]. The research proceeded through four sequential stages: (1) participant sampling, (2) instrument administration and data collection, (3) measurement of variables, and (4) hierarchical regression analysis.

B. Participants and Sampling

The target population consisted of all active students at the Faculty of Education and Psychology, Mandalika University of Education, Indonesia. Stratified random sampling was employed with stratification based on study program (Educational Administration, Guidance and Counseling, Community Education, and Educational Technology) and semester (3, 5, 7, and 9). A total of 185 students participated in this study. The majority of respondents were from Educational Technology (37.8%, $n = 70$), followed by Guidance and Counseling (33.0%, $n = 61$), Educational Administration (21.6%, $n = 40$), and Community Education (7.6%, $n = 14$). In terms of semester distribution, most respondents were in semester 3 (38.9%, $n = 72$), followed by semester 7 (25.4%, $n = 47$), semester 5 (24.3%, $n = 45$), and semester 9 (11.4%, $n = 21$). Female students predominated (62.7%, $n = 116$) compared to males (37.3%, $n = 69$). Most respondents had GPAs above 3.50 (64.3%, $n = 119$).

C. Variables and Instruments

The dependent variable in this study was reading literacy, defined as students' ability to understand, analyze, and interpret reading texts, measured using multiple-choice test scores designed based on specific texts for each study program, with scores ranging from 0 to 100. Independent variables included: (1) digital literacy, defined as students' ability to access and navigate digital technology, measured using a 10-item Likert scale questionnaire; (2) academic engagement, defined as students' involvement in academic activities; and (3) demographic

variables, including gender, latest GPA, semester, and study program. Interaction variables were created by multiplying academic engagement and digital literacy with demographic variables (gender, GPA, and semester) to test moderation effects [13].

All instruments were validated through expert judgment prior to administration. The questionnaires demonstrated adequate reliability for research purposes.

D. Data Collection Procedure

All instruments were distributed online using Google Forms. The introduction and informed consent were included at the beginning of the form to explain the research objectives, the voluntary nature of participation, and data confidentiality guarantees. Participants were informed that their responses would be anonymized and used solely for research purposes. The study received appropriate institutional approval, and all procedures followed ethical guidelines for research involving human participants.

E. Data Analysis

Data analysis employed descriptive statistics followed by hierarchical multiple regression analysis. This method was chosen because it can separate the contribution of each variable group systematically, allowing the effects of control variables, main variables, and moderation variables to be analyzed in stages. Hierarchical regression also enables researchers to assess the increase in predictive ability of the model (ΔR^2) after adding new variable blocks [13]. Analysis was conducted in three stages: Model 1 included demographic control variables (gender, GPA, semester, and study program); Model 2 added the main variables (academic engagement and digital literacy); and Model 3 included interaction variables to test moderation effects. Prior to analysis, all classical assumptions were tested including residual normality, linearity, homoscedasticity, residual independence (Durbin-Watson), and multicollinearity (Tolerance and VIF). All analyses were performed using IBM SPSS Statistics with a 5% significance level.

Results

A. Descriptive Statistics

Table 1 presents the descriptive statistics for the main variables. The reading literacy variable had a mean of 77.44 (SD = 22.02), indicating that students' reading literacy was generally in the good category, although there was considerable variation among respondents (range 0-100). The mode for reading literacy was 100, indicating that 43 students (23.2%) answered all questions correctly. Digital literacy had a mean of 37.32 (SD = 4.78) from a score range of 26-50, suggesting that students' perceptions of their digital literacy competencies were moderately high. Academic engagement had a mean of 15.04 (SD = 2.59) from a score range of 8-20, indicating moderate to high levels of academic involvement among students.

Table 1. Descriptive Statistics of Main Variables

Variable	Mean	SD	Min	Max
Reading Literacy	77.44	22.02	0	100
Digital Literacy	37.32	4.78	26	50
Academic Engagement	15.04	2.59	8	20

B. Assumption Testing

Prior to conducting hierarchical regression analysis, classical assumption tests were performed. Residual normality was assessed through histogram and Normal P-P Plot examination, which showed that residual distribution approached a normal curve with mean residual values close to zero (Mean = 4.40E-15), indicating that the normality assumption was met. Homoscedasticity was evaluated through the scatterplot between standardized predicted values and standardized residuals, showing relatively random scatter patterns without forming specific patterns, thus meeting the homoscedasticity assumption. Residual independence, assessed through the Durbin-Watson statistic (1.669), fell within the acceptable range (close to 2), indicating no autocorrelation in residuals. Multicollinearity assessment for Models 1 and 2 showed Tolerance values ranging from 0.713 to 0.929 (> 0.10) and VIF values ranging from 1.076 to 1.403 (< 10), indicating no multicollinearity. However, Model 3, which included interaction variables, exhibited high multicollinearity with VIF values reaching 44-158, requiring cautious interpretation.

C. Hierarchical Regression Results

Hierarchical regression analysis was conducted in three stages to answer the research questions. The summary of results is presented in Table 2.

Table 2. Hierarchical Regression Model Summary

Model	R ²	ΔR^2	F	F Change	Sig. F Change	DW
1	.124	.124	4.207**	4.207**	.001	
2	.179	.055	4.786**	5.887**	.003	
3	.200	.021	3.484**	0.744	.615	1.669

Note: ** $p < .01$.

Model 1 (Effect of Demographic Variables): Demographic variables consisting of semester, gender, latest GPA, and study program collectively explained 12.4% of the variance in reading literacy ($R^2 = .124$). This model was statistically significant, $F(6, 178) = 4.207$, $p = .001$, indicating that demographic factors contributed significantly, though relatively small, to students' reading literacy.

Model 2 (Addition of Academic Engagement and Digital Literacy): After adding academic engagement and digital literacy variables, the predictive ability of the model increased to 17.9% ($R^2 = .179$). The increase in R^2 of 5.5% ($\Delta R^2 = .055$) was statistically significant, $F \text{ Change} = 5.887$, $p = .003$, indicating that digital literacy and academic engagement provided additional meaningful contributions in explaining variance in reading literacy beyond demographic factors.

Model 3 (Addition of Interaction Variables for Moderation Testing): The addition of interaction variables only increased R^2 by 2.1% to 20.0%. This increase was not statistically significant, F Change = 0.744, p = .615, indicating that demographic variables (gender, GPA, and semester) did not moderate the relationship between academic engagement and digital literacy with reading literacy.

Table 3. Model 2 Regression Coefficients

Variable	B	SE	β	t	Sig.	VIF
(Constant)	29.846	14.79		2.018	.045	
Gender	-8.253	3.26	-.182	-2.530	.012*	1.076
Program (Community Ed.)	13.724	6.13	.165	2.238	.026*	1.133
Digital Literacy	1.137	0.34	.247	3.342	.001**	1.139
Academic Engagement	0.563	0.64	.066	0.878	.381	1.181

Note: * p < .05; ** p < .01.

Based on Table 3, Model 2 revealed that gender had a significant negative effect on reading literacy (β = -.182, t = -2.530, p = .012). With coding male = 1 and female = 0, this result indicates that male students tended to have lower reading literacy scores compared to female students, with an average difference of approximately 8.25 points after controlling for other variables. The Community Education study program had a significant positive effect on reading literacy compared to the reference program (Educational Technology) (β = .165, t = 2.238, p = .026), with students from Community Education having reading literacy scores averaging 13.72 points higher than Educational Technology students. Digital literacy had a significant positive effect on reading literacy (β = .247, t = 3.342, p = .001), with each one-unit increase in digital literacy score associated with a 1.14-point increase in reading literacy score. Digital literacy was the strongest predictor in this model. Semester, latest GPA, Educational Administration program, Guidance and Counseling program, and academic engagement did not significantly affect reading literacy (p > .05).

Discussion

The finding that female students exhibited higher reading literacy scores than males is consistent with prior research. The OECD [1] reported that globally, there exists a gender gap in reading literacy where females tend to outperform males. This pattern has been documented across various international assessments including PISA and PIRLS, with gender differences appearing as early as primary school and persisting through secondary education [14]. The gender gap can be explained by several factors, including differences in reading interest and habits, where females generally demonstrate greater interest in reading activities and spend more time reading compared to males [11]. Additionally, gender socialization plays a role, as females tend to be more encouraged to develop verbal and reading skills from an early age [15]. Recent meta-analyses indicate that while the gender gap in reading is consistent across cultures, its magnitude varies depending on assessment features and contexts [16].

The differences in reading literacy among study programs, particularly the advantage of Community Education students over Educational Technology students, can be attributed to curriculum characteristics and academic demands of each program. The Community Education program has a strong orientation toward community empowerment and non-formal education, requiring the ability to read and understand various social-community texts. Conversely, the non-significant differences between Educational Administration and Guidance and Counseling programs with Educational Technology suggest that variation in reading literacy is more determined by individual factors rather than curricular differences [17]. This finding aligns with theoretical perspectives suggesting that domain-specific reading demands may differentially influence literacy development across academic disciplines [18].

The non-significant effect of semester on reading literacy is a noteworthy finding. This indicates that reading literacy does not automatically improve with increased study duration. This finding aligns with the view that reading literacy is more determined by motivation and reading habits than by length of exposure to formal learning [19]. Recent research on pathways to digital reading literacy suggests that propensity factors, particularly metacognitive reading strategies and reading self-concept, make greater contributions to reading performance than opportunity factors alone [8]. The implication is that systematic efforts are needed to develop students' reading literacy at every semester level, rather than relying on natural development.

Among all predictors examined, digital literacy emerged as the strongest and most consistent determinant of reading literacy. This finding provides empirical confirmation of the theoretical relationship between both constructs and extends prior research that has examined them largely in isolation or through qualitative approaches [5]. The mechanism underlying this relationship can be explained through several complementary pathways. Students with stronger digital literacy are better equipped to access and navigate diverse digital reading sources, thereby broadening their exposure to academic texts [20]. Furthermore, the ability to critically evaluate digital information constitutes an essential component of comprehending and analyzing reading materials, whether in digital or traditional formats [21]. Technical proficiency in using digital tools—such as annotation applications, digital dictionaries, and online learning platforms—further supports active and effective reading practices [22]. What is particularly noteworthy is that this positive effect of digital literacy was not contingent upon students' demographic characteristics, a finding that will be discussed further in the context of moderation analysis below. This universality suggests that digital literacy functions as a foundational competency for reading literacy development—one that operates independently of gender, academic standing, or study duration. Conceptually, this positions digital literacy not merely as a supplementary skill but as a core enabler of reading literacy in contemporary higher education, particularly for teacher

education students whose own literacy competencies will shape the instructional quality they deliver to future learners.

Conversely, academic engagement did not significantly predict reading literacy when other variables were controlled, a finding that warrants further examination. Theoretically, high academic engagement should correlate with better literacy abilities [7]; however, this relationship was not empirically supported in the present context. Several possible explanations can be proposed. First, the operationalization of academic engagement in this study may not have captured dimensions directly related to reading activities, such as reading-specific behavioral or cognitive engagement. Second, the relationship between academic engagement and reading literacy may be indirect—mediated by variables such as reading strategy use or self-regulated learning—or non-linear [23]. Third, the sample characteristics, dominated by students with high GPAs (64.3% above 3.50), may have restricted the variance in academic engagement, thereby attenuating its predictive power. This finding contrasts with meta-analytical evidence showing positive associations between engagement and learning outcomes [24], and suggests that future studies should employ more domain-specific engagement measures that capture reading-related academic behaviors.

The moderation analysis revealed that demographic variables did not significantly moderate the relationships between digital literacy or academic engagement and reading literacy. This absence of moderation effects constitutes one of the most important findings of this study, as it demonstrates that the benefits of digital literacy for reading literacy are consistent across gender, GPA levels, and semester stages. In practical terms, this means that female and male students, high- and low-achieving students, and students at various points in their academic trajectory all benefit equally from improvements in digital literacy [25]. This finding carries significant conceptual novelty: while previous research has established that digital literacy predicts various academic outcomes, few studies have tested whether this predictive relationship holds uniformly across demographic subgroups within a single analytical framework. The present study provides evidence that it does, thereby reinforcing the notion that digital literacy operates as a universal—rather than group-specific—facilitator of reading literacy. From an intervention standpoint, these results provide a strong empirical basis for implementing digital literacy programs universally across all student groups in teacher education, without the need for demographic-based differentiation [26].

It should be noted that Model 3 interpretation must be approached with caution given the high multicollinearity in interaction variables (VIF reaching 44-158). High multicollinearity can cause standard error inflation and coefficient estimate instability, thus affecting the reliability of significance testing [13]. For future research, mean-centering techniques on

predictor variables before forming interaction variables or alternative analytical approaches such as moderated regression with bootstrap are recommended [27].

Conclusion

This study examined the determinants of reading literacy among university students, focusing on the roles of digital literacy, academic engagement, and demographic factors. The hierarchical regression analysis revealed three key findings. First, demographic variables collectively explained a significant portion of variance in reading literacy, with gender and study program emerging as significant predictors. Female students demonstrated higher reading literacy than males, and Community Education students outperformed those in other programs, while semester and GPA did not significantly predict reading literacy. Second, digital literacy emerged as the strongest predictor of reading literacy, contributing an additional 5.5% of explained variance beyond demographic factors. Notably, academic engagement did not significantly predict reading literacy when controlling for other variables, suggesting that the relationship between engagement and literacy may be more complex than theoretically anticipated. Third, the absence of moderation effects indicates that the benefits of digital literacy on reading literacy are consistent across demographic groups.

These findings carry important implications for both practice and research. For teacher education institutions, the results provide a strong empirical basis for integrating digital literacy programs into the curriculum—whether through dedicated courses, technology-enhanced workshops, or embedding digital competencies within existing coursework. Given that digital literacy benefits are universal across demographic groups, such programs can be implemented broadly without requiring demographic-based differentiation. Additionally, specific strategies should be developed to address the gender gap in reading literacy, particularly by designing reading interventions that align with male students' interests and learning preferences.

Several limitations should be acknowledged. The cross-sectional design limits causal inferences, the sample from a single faculty restricts generalizability, and the self-report measures for digital literacy and academic engagement may introduce response bias. The high multicollinearity in Model 3 interaction variables also warrants cautious interpretation of the moderation findings.

Future research should consider: (a) employing performance-based digital literacy assessments to complement self-report measures; (b) exploring potential mediating variables—such as reading strategy use or self-regulated learning—that may explain the non-significant relationship between academic engagement and reading literacy; (c) applying variable centering techniques or alternative analytical approaches such as bootstrapped

moderated regression to address multicollinearity; and (d) expanding the sample to multiple faculties and institutions to enhance generalizability.

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Conflict of Interest

The authors declare no conflict of interest.

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Authors



Muhammad Iqbal   is a lecturer at the Faculty of Education and Psychology, Universitas Pendidikan Mandalika, Indonesia. He specializes in Educational Research and Evaluation, with academic training from Yogyakarta State University (Master's) and Jakarta State University (Doctorate). He teaches courses in research methodology and statistics. In addition, he actively serves as an assessor and instructor for BAN PDM in West Nusa Tenggara Province. His work focuses on improving research quality and evaluation practices in education. (email: muhammadiqbal@undikma.ac.id).



Bambang Robiin   is a lecturer at Universitas Ahmad Dahlan, Yogyakarta, Indonesia. He specializes in information technology and information systems, with extensive experience in teaching, research, and community service. He has authored numerous books on IT-related topics and continues to contribute to the development of digital knowledge and innovation. His academic work focuses on the application of technology in education and society. He is also actively involved in community-based IT initiatives. (email: bambang.robiiin@tif.uad.ac.id).



Agus Jayadi   is a lecturer and researcher in education and culture at Mandalika University of Education (UNDIKMA), Mataram, Indonesia. He earned his Master's and Doctoral degrees in Educational Research and Evaluation from Jakarta State University. His research focuses on Indonesian education, cultural studies, and evaluation practices. He is also the founder and advisor of Balai Budaya Lendang Selaparang, promoting cultural preservation and education. Agus actively engages in research and community initiatives. (email: agusjayadi@undikma.ac.id).



Rila Hardiansyah  is a lecturer at the Faculty of Education and Psychology, Mandalika University of Education, Indonesia. His expertise lies in community empowerment, with a strong focus on advancing reading literacy through non-formal education. He is actively involved in research and advocacy aimed at improving literacy access and quality for diverse communities. His work emphasizes practical and community-based educational approaches. Rila contributes to various literacy development programs and initiatives. (email: rilahardiansyah@undikma.ac.id).



Ahmad Muslim is a lecturer at the Faculty of Education and Psychology, Mandalika University of Education, Indonesia. His research focuses on reading literacy in non-formal education sectors, including NGOs and community-based initiatives. His work is driven by a commitment to civil society advocacy and improving educational access for underserved populations. He actively engages in research and community development projects related to literacy. Ahmad contributes to strengthening literacy movements in Indonesia. (email: ahmadmuslim@undikma.ac.id).