

## Research Article

# Beyond Geographical Barriers: ICT Skills and Parental Involvement in Fostering Learning Independence

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## ABSTRACT

This study analyses the links between students' Information and Communication Technology (ICT) abilities, parental role, and learning Independence in North Maluku, an archipelagic region of Indonesia characterized by poor technical infrastructure. By implementing a quantitative, cross-sectional approach, data were collected from 303 high school students using validated measures of ICT abilities, parental involvement, and learning independence. Multiple regression research found that ICT skills and parental role combined account for 44% of the variance in learning independence. ICT abilities emerged as a robust predictor ( $\beta = .464, p < .001$ ) of learning independence, underlining the essential significance of digital literacy in supporting autonomous learning practices, particularly in technologically impoverished locations. The parental role also revealed a substantial impact ( $\beta = .295, p < .001$ ), showing the persistent importance of family support in the educational process, especially in technology-enhanced learning contexts. These findings have substantial implications for educational policy and practice in archipelagic and technologically challenged countries, highlighting the necessity for focused ICT skill development programs and attempts to improve parental involvement in technology-mediated learning.

**Keywords:** ICT Skills; Parental Role; Learning Independence; Archipelagic Region

## 1. INTRODUCTION

In today's digital era, possessing Information and Communication Technology (ICT) abilities has become essential for students to succeed. A staggering 95% of educators acknowledge these skills' criticality in preparing students for the future workforce (Jiménez-Hernández et al., 2020). Nevertheless, acquiring these talents is only evenly available in some geographic places, especially in archipelagic regions with restricted connectivity (Faizah et al., 2021).

North Maluku, an Indonesian region consisting of many islands divided by the sea (Daud et al., 2023), offers a distinctive case study in this setting. The archipelagic structure of North Maluku presents substantial obstacles to both the accessibility and quality of education (Nandang Mustafa, 2023). A significant number of islands in this particular area suffer from an absence of dependable internet access, resulting in a division between those who have access to digital resources and those who do not (Effendi et al., 2022). This division directly influences students' capacity to acquire and develop essential information and communication technology (ICT) skills (García Zare et al., 2023). This isolation has a dual impact on students' ability to use digital resources and on the involvement of parents in supporting their children's education (Schmidt et al., 2021). It is particularly significant given recent global events that have expedited the implementation of remote learning in more technologically advanced.

An in-depth study is necessary to understand the complex educational environment in North Maluku, which is influenced by geographical isolation, limited technological infrastructure, and the growing significance of ICT skills in education. Although the significance of ICT skills and parental involvement in education is acknowledged, there is a limited understanding of how these factors impact students' ability to learn independently (Wang, 2024), especially in technologically underserved areas such as North Maluku. The acquisition of self-reliance, which refers to students' capacity to assume responsibility for their learning, has become a vital competency in the educational framework of the 21st century (Marope, 2014). Nevertheless, the specific ways in which ICT skills and parental participation contribute to the development of independence in physically isolated places have yet to be thoroughly investigated. The widening educational gaps in locations with low connectivity may be exacerbated by the growing global dependence on digital technologies for both in-school and at-home learning, as highlighted by (Hampton et al., 2020).

Although earlier research has independently assessed ICT skills (Qazi et al., 2022) and parental participation (Williams-Johnson & Gonzalez-DeHass, 2022), there is a lack of studies that have explored their combined influence on learning independence, particularly in archipelagic settings with restricted internet connectivity (Hammer et al., 2021). This research gap is particularly significant to policymakers and educators who aim to tackle educational disparities in locations such as North Maluku.

This study will examine the complex correlation among pupils' ICT proficiency, parental engagement, and self-reliance in these underprivileged technological locations, expanding on current discoveries about digital literacy in rural places. In addition, the primary objective of this research is to create a thorough model that elucidates the interplay between various factors to understand their impact on learning outcomes in isolated archipelagic regions. This research contributes to the expanding literature on educational resilience in challenging environments. This study adds to the expanding collection of scholarly works on educational technology and student independence, explicitly addressing the challenge of overcoming geographical and technological obstacles. Furthermore, the research seeks to provide valuable insights into the field of educational technology and inform practices that improve students' ability to learn independently in geographically isolated and technologically underserved regions of North Maluku. It focuses on the intricate relationship between students' ICT skills, parental involvement, and learning independence, taking into account the unique challenges posed by the archipelagic nature of the region.

## 2. RESEARCH METHOD

### 2.1 Research Design

This study employed a quantitative, cross-sectional research methodology to investigate the influence of students' information and communication technology (ICT) abilities and parental role on their capacity for independent learning. The cross-sectional approach was chosen to capture a snapshot of the relationships between variables at a particular moment, allowing for quick data collection and analysis of current patterns. This design is appropriate for examining the associations between variables and predicted relationships, which is in line with our study goals.

### 2.2 Participant

The study sample consisted of 303 high school students, comprising 150 females and 153 men, who were chosen from five public senior high schools in North Maluku Province. The age of the participants varied between 14 and 18 years, with an average of 16.2 years and a standard deviation of 1.3 years. The sample comprised of 100 students from grade 9, 100 students from grade 10, and 103 students from grade 11. A stratified random sample method was employed to ensure that each grade level and gender group were represented proportionally. Participants were required to fulfill inclusion criteria, which encompassed possessing uninterrupted access to a computer or smart device at their place of residence and being enrolled as full-time students in one of the institutions involved in the study. To maintain uniformity in the educational setting of the sample, students with significant learning challenges or those participating in specialized educational programs were excluded from the study.

### 2.3 Instruments

The study assessed three primary factors using approved and reliable instruments. The initial step involves evaluating the ICT proficiency of students through the utilization of the performance-based ICT Skills Assessment (Kaarakainen et al., 2018), a self-report instrument consisting of 20 items. Participants assessed their performance in various ICT tasks using a 5-point Likert scale, with 1 indicating no proficiency and 5 indicating very high proficiency. The instrument covers four domains: basic computer operations, internet usage, software application usage, and digital problem-solving. The Parental Role was assessed using the Parental Involvement in Technology-Enhanced Learning Scale (Septiana & Mohamed, 2023), a 15-item questionnaire that measures parental support and participation in students' technology-based learning activities. The items were assessed with a 5-point Likert scale, with 1 denoting "Strongly disagree" and 5 denoting "Strongly agree". The scale comprises three subscales: technical assistance, instructional direction, and supervision. Finally, the degree of autonomy in learning was evaluated using the Student Learning Independence Scale (Belawati et al., 2023), a 25-item instrument that gauges students' ability to effectively manage their own learning process. Respondents utilized a 5-point Likert scale to submit their answers, with 1 denoting "Never" and 5 denoting "Always". The instrument will be evaluated on five dimensions: goal setting, time management, self-motivation, self-evaluation, and resource utilization.

### 2.4 Data Collection

The surveys were administered electronically through the use of Google Forms. Participants completed the surveys in computer labs during normal school hours, under the supervision of competent research assistants. To mitigate the impact of potential confounding variables, researchers collected data on the participants' prior academic achievements and socioeconomic status, including parental education and income. The purpose of collecting this data was to use it as control variables in the study.

### 2.5 Data Analysis

The data analysis was conducted via IBM SPSS Statistics version 27.0. The preliminary analyses were computing descriptive statistics, assessing the normal distribution of the data, and exploring the associations among the research variables. The main study employed hierarchical multiple regression analysis to examine the influence of students' ICT

skills and parental involvement on their level of autonomy in learning. The assumptions of multiple regression were evaluated and determined to be met. The normality of residuals was confirmed by using One-Sample Kolmogorov-Smirnov test. Homoscedasticity was verified by analysing plots of residuals plotted against predicted values. Furthermore, multicollinearity was evaluated by computing the Variance Inflation Factors (VIF). All Variance Inflation Factor (VIF) values were determined to be less than 3, indicating the lack of any notable multicollinearity. The issue of missing data, which constituted less than 5% for each variable, was resolved by employing multiple imputations. A total of 20 imputed datasets were generated. Cook's distance was used to identify outliers, and no influential outliers were observed (all values were below 1). The statistical tests utilised a significance level of  $\alpha = .05$ , and the effect sizes were conveyed using standardised beta coefficients and  $R^2$  values.

### 3. RESULTS AND DISCUSSION

#### 3.1 Descriptive statistics

The descriptive statistics on Table 1 provides valuable insights into the distribution of scores for Parental role, ICT skills, and Learning Independence across a sample of 303 participants.

**Table 1.** Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Parental role	303	67,93	10,979	31	97
ICT skills	303	98,90	13,685	61	140
Learning Independence	303	101,00	12,126	69	139

The average scores reveal remarkable patterns among the elements. The mean ratings for ICT skills and Learning Independence are much higher (98.90 and 101.00, respectively) than the mean score for Parental role (67.93). These data suggest that, on average, individuals possess higher degrees of technical proficiency and independent learning ability than parental involvement in their educational journey. Examining the standard deviations offers a more profound comprehension of the degree to which responses differ. The participants demonstrate a wide range of technological proficiencies, as indicated by the high standard deviation 13.665 in ICT abilities. The data shows a significant association ( $SD = 12.126$ ) between the development of independence and the existence of various self-directed learning practices. The parental role exhibits low variability, with a standard deviation of 10.979, indicating a higher level of consistent parental involvement across the entire sample. The minimum and maximum values accurately depict the range of responses. The sample exhibits a broad spectrum of ICT skills, with scores ranging from 61 to 140, showcasing the diverse technological aptitude of the participants. The scores for Learning Independence vary significantly, ranging from 69 to 139. Nevertheless, even the most minimal amounts of independence recorded are significant, as evidenced by the elevated minimum score. The parental role, however, constrained within a spectrum of 31 to 97, displays notable variation in the extent of parental engagement.

#### 3.2 Assumption Test Result

##### 3.1.1 Normality Test

The results of the One-Sample Kolmogorov-Smirnov test provide important information about the normalcy of the data distribution for Parental Role, ICT Skills, and Learning Independence. This test aims to evaluate whether the data meets the essential assumptions for different parametric statistical analyses, such as multiple regression.

**Table 2.** One-Sample Kolmogorov-Smirnov Test

N		303	303	303
Normal Parameters <sup>a,b</sup>	Mean	67,93	98,90	101,00
	Std. Deviation	10,979	13,685	12,126
Most Extreme Differences	Absolute	,032	,061	,066
	Positive	,031	,061	,066
	Negative	-,032	-,033	-,039
Kolmogorov-Smirnov Z		,564	1,068	1,147
Asymp. Sig. (2-tailed)		,908	,204	,144

a. Test distribution is Normal.

b. Calculated from data.

The table 2 displays the main elements, which include the Kolmogorov-Smirnov Z values and their corresponding Asymp. Sig. (2-tailed) values, generally known as p-values. All three components exhibit p-values greater than the conventional significance level of 0.05 (Parental Role: 0.908, ICT Skill: 0.204, Learning Independence: 0.144). This conclusion suggests that the null hypothesis of normalcy for each variable cannot be disproven, leading to a failure to do so. In practical terms, these results indicate that the distributions of Parental Role, ICT Skill, and Learning Independence are not significantly different from a normal distribution.

### 3.1.2 Multicollinearity test

Assessing multicollinearity is a crucial aspect of multiple regression analysis, since it ensures the reliability and stability of the model's predictions. The table 3 provides crucial information on the multicollinearity of the independent variables in the regression model, including the Parental Role and ICT abilities.

**Table 3.** Multicollinearity Test Result

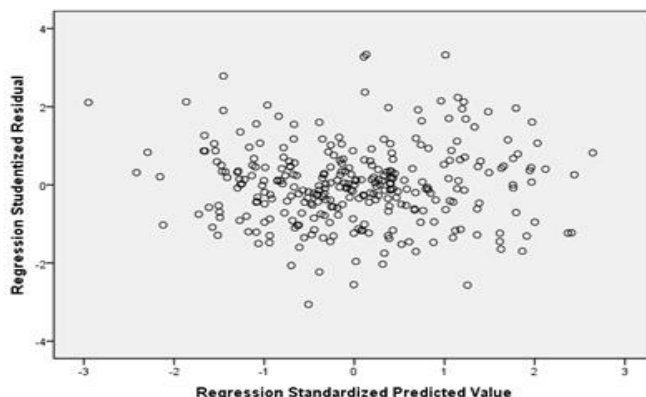
Model		Unstandardized Coefficients		Standardized Coefficients	t	Collinearity Statistics	
		B	Std. Error	Beta		Tolerance	VIF
1	(Constant)	38,172	4,128		9,247		
	Parental Role	,326	,055	,295	5,918	,750	1,333
	ICT skills	,411	,044	,464	9,301	,750	1,333

a. Dependent Variable: Learning Independence

The Collinearity Statistics column in Table 3 presents two significant metrics for evaluating multicollinearity: Tolerance and VIF (Variance Inflation Factor). The Parental Role and ICT skills had identical values: a Tolerance of 0.750 and a VIF of 1.333. These charts provide compelling data regarding the correlation between independent variables. After examining these findings, we have identified highly positive indicators. The Tolerance value of 0.750 exceeds the problematic threshold of 0.1, which is widely used as a cutoff point in statistical studies. Moreover, the VIF value of 1.333 is much below the commonly accepted threshold of 10, considered the highest acceptable level for multicollinearity. The VIF (Variance Inflation Factor) is the reciprocal of Tolerance, resulting in both variables having identical values. The findings suggest no significant correlation between Parental Role and ICT ability in the regression model.

### 3.1.3 Heteroscedasticity test

The scatterplot of standardised residuals plotted against standardised predicted values for Learning Independence provides valuable insight into the assumption of homoscedasticity in the regression model. The figure 1 exhibits a scatter of data points that appear to be randomly distributed down the horizontal axis. There are no noticeable patterns or continuous fluctuations in the spread of residuals across the whole range of projected values. The uniform distribution found in this case suggests that the variability of the errors remains consistent, indicating the lack of significant heteroscedasticity.



**Figure 1.** Scatterplot

### 3.3 Multiple Regression Test Result

The Table 4 presents the results of the multiple regression analysis, offering valuable insights into the relationships between two independent variables ( $X_1$  and  $X_2$ ) and the dependent variable, which can be inferred as Learning Independence. The overall model fit is impressive, as indicated by an R-value of 0.663, demonstrating a relatively robust positive correlation between the variables and Learning Independence. The R Square value of 0.440 signifies that the model accounts for 44% of the variability in Learning Independence, which is a substantial proportion in social science research. The significance of the model is confirmed by the Sig F value of 0.000 ( $p < 0.001$ ), indicating its statistical validity.

**Table 4.** Summary of Multiple Regression Test Result

Variabel	B		t	Sig	Correlations		
	Unstandardized Coefficients	Standardized Coefficients			Zero-Order	Partial	Part
Konstanta	38,172		9,247	,000			
$X_1$	,326	,295	5,918	,000	,527	,323	,256
$X_2$	,411	,464	9,301	,000	,612	,473	,402
R	= 0.663						
R Square	= 0.440						
Sig F	= 0.000						

After examining the individual predictors, it is clear that both  $X_1$  (representing Parental Role) and  $X_2$  (representing ICT Skills) significantly contribute to the development of Learning Independence. The variable  $X_1$  has an unstandardised coefficient of 0.326 and a standardised coefficient (Beta) of 0.295. In contrast, the variable  $X_2$  exerts a more significant influence, as evidenced by its unstandardised coefficient of 0.411 and Beta value of 0.464. Both variables' p-values ( $p < 0.001$ ) indicate their statistical significance in the model. The correlation coefficients provide further context. The variable  $X_1$  exhibits zero-order, partial, and part correlations of 0.527, 0.323, and 0.256, respectively.  $X_2$  has stronger correlations across all categories: 0.612 (zero-order), 0.473 (partial), and 0.402 (part). The statistics provide evidence that  $X_2$  exhibits a more robust link with Learning Independence when compared to  $X_1$ . In practical terms, this research suggests that both the parental role and ICT skills have a significant impact on explaining learning independence. Nevertheless, ICT Skills have a more noticeable impact. For every incremental unit in the Parental Role, there is a 0.326 unit increase in Learning Independence, assuming ICT Skills remain the same. Conversely, a single unit increase in ICT Skills is associated with a 0.411 unit increase in Learning Independence while holding the Parental Role constant. The model summary table (Table 5) suggests that the multiple correlation coefficient (R) of 0.663 reveals a strong positive relationship between the predictors and the Learning Independence. This suggests that when proficiency in ICT abilities and parental involvement improve, there is a commensurate tendency to develop learning independence. The strength and durability of this link are exceptional, highlighting the importance of these factors in understanding student independence in the learning process.

Table 5. Model Summary

Model Summary <sup>b</sup>							
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	Sig. F Change
1	.663 <sup>a</sup>	.440	.436	9.106	.440	117.723	.000

a. Predictors: (Constant), ICT skills, Parental Role

b. Dependent Variable: Learning Independence

The coefficient of determination (R Square) of 0.440 provides significant and valuable information. The research indicates that 44% of the difference in Learning Independence can be attributed to the combined impact of ICT Skills and Parental Role. In social science research, this has significant explanatory power, highlighting the crucial role of these factors in shaping students' capacity for independent learning. The Adjusted R Square score of 0.436 additionally reinforces the model's robustness. The slight difference between R Square and Adjusted R Square (0.440 vs 0.436) suggests that the model is not overfitted since it maintains its capacity to produce correct predictions while considering the number of predictors used. The model's statistical significance is strongly supported by the F Change value of 117.723 and its supporting Sig. F Change of 0.000 ( $p < 0.001$ ). The extremely low p-value indicates that the observed relationship between the predictors and Learning Independence is improbable to have occurred by chance. The regression model indicates that ICT Skills and Parental Role are significant predictors of Learning Independence, accounting for a substantial portion of its variability. The model's statistical significance and excellent explanatory power provide a solid foundation for understanding the factors that impact students' ability to learn independently. However, it is crucial to recognise that 56% of the variability is still unexplained, suggesting the existence of other factors not included in this model that also play a role in the development of learning independence.

### 3.4 Discussion

#### 3.4.1 ICT Skills and Learning Independence

The significant correlation ( $\beta = .464$ ) between ICT skills and learning independence indicates that pupils with advanced technological proficiency are more inclined to demonstrate independent learning behaviours. This discovery is consistent with the current comprehension of how digital literacy contributes to educational results. According to Lemmetty (2020), ICT skills are essential in promoting self-directed learning in the digital era. The findings of our study corroborate this perspective, suggesting that students with higher proficiency in utilising technology may possess superior skills in accessing online resources, handling digital learning platforms, and resolving challenges autonomously. The robustness of this association is especially remarkable considering the archipelagic setting of North Maluku. According to Wijaya (2023), students in rural parts of Indonesia frequently struggle to acquire digital literacy skills because of inadequate infrastructure. This research indicates that even though students may face difficulties, acquiring ICT skills will dramatically improve their ability to learn independently. The relationship can be elucidated using the self-efficacy theory framework (Bandura, 2001). Students who possess advanced ICT abilities are more likely to have a better level of confidence in their capacity to use technology for educational purposes, which in turn results in an increase in self-directed learning behaviours. Vaičiūnienė (2023) highlight in his systematic review that there is a strong association between technology proficiency and increased levels of self-directed learning, which is a crucial aspect of developing learning autonomy.

This research focuses on ICT skills, parental role, and learning freedom in North Maluku, Indonesia. It supports and expands upon existing research in various important domains. By analysing these elements in a location characterised by a group of islands and a lack of technological resources, our research provides significant contributions to the current body of knowledge.

Regarding ICT skills and their influence on schooling, the findings strongly endorse recent research that highlights the significance of digital literacy. The strong positive connection we discovered between ICT abilities and learning independence ( $\beta = .464, p < .001$ ) supports the findings of Pala and Başbüyük (2023), who established a positive association between digital literacy and academic achievement in various educational contexts. Nevertheless, our research expands upon this comprehension by explicitly connecting ICT abilities to developing self-reliance in learning rather than solely focusing on academic achievements. The significance of our findings is particularly notable when considering locations that lack access to advanced technology. Although Rasimin (2024) and Qumillaila (2022) focused on identifying the difficulties in developing digital literacy skills among rural Indonesian students, our study highlights the notable and beneficial influence of ICT skills even in such demanding circumstances. This enhances our comprehension of how digital literacy impacts educational achievements in situations with limited resources. The study further substantiates the qualitative findings of Pacheco (2019) by quantitatively demonstrating the significant correlation between ICT abilities and the ability to learn independently. Their thorough review emphasised the significance of technology in facilitating self-directed learning, and our findings provide empirical proof for this correlation, reinforcing the argument for prioritising the development of ICT skills in educational programs.

### 3.4.2 Parental Role and Learning Independence

The study discovered a statistically significant positive relationship ( $\beta = .295$ ) between parental role and the development of learning independence. While the correlation between parental engagement and students' autonomous learning habits is not as strong as that of ICT skills, it nonetheless emphasises the critical role that parental engagement plays in developing such behaviours. This finding is consistent with previous research on the involvement of parents in technology-enhanced learning environments. Vogel et al. (2023) emphasise the ongoing significance of parental engagement in the era of remote education, although novel challenges and possibilities exist. The study's results confirm this viewpoint, demonstrating that parental support is essential in promoting students' capacity for self-directed learning, even in areas without technological resources. The positive impact of parental involvement can be understood within the framework of social cognitive theory (Bandura, 2001). Parents who actively promote and support their children's learning, especially in situations involving technology, can be role models for their children to cultivate self-regulated learning practices. Furthermore, they might provide scaffolding that gradually promotes greater autonomy in the learning process. A study conducted by Yulianti et al. (2019) on remote Indonesian islands showed that when parents actively engaged in online learning, it led to improved student outcomes. Our research builds upon prior studies by establishing a correlation between parental engagement and cultivating self-directed learning abilities within a setting typified by a cluster of islands.

Our analysis aligns with contemporary research on the evolving role of parents in the digital age. The significant impact of parental role on the development of learning independence ( $\beta = .295, p < .001$ ) supports the conclusions of Brown et al. (2023), who examined the challenges and benefits of family involvement in remote education. Our research builds upon other studies by accurately quantifying the impact on self-reliance in learning, providing a fresh viewpoint to our understanding of parental influence in the context of digital education. The significance of the parental role in our technologically limited environment is incredibly fascinating. This study builds upon and improves upon the research completed by Kusaeri (2018), who found positive connections between parental involvement and academic performance among students residing in remote Indonesian islands. Our data surpasses expectations by revealing a distinct correlation between parental involvement and the development of independent learning skills. We offer novel insights into parental involvement's impact in educational settings with limited resources. The study's findings on parental involvement align with the general trends observed in meta-analytic studies. Wilder (2014) and Castro et al (2015) conducted a meta-analysis to investigate the impact of parental participation on student achievement. The results of our study are consistent with their overall findings since we observed a substantial positive impact on student's ability to learn independently. It underscores the importance of parental involvement in education.

### 3.4.3 Interplay Between ICT Skills and Parental Role

The correlation between ICT abilities and parental role, which explains 44% of the variability in learning independence, highlights the intricate relationship between technical proficiency and family support in fostering self-directed learning. This finding aligns with the ecological systems theory (Bronfenbrenner, 1977; Kitchen et al., 2019), emphasising the need to consider multiple environmental factors when understanding educational outcomes. Afsal et al (2023) argue that to tackle the digital divide, it is essential to increase access to technology and strengthen support systems for learners. The results of our study support this holistic approach, suggesting that both technical expertise and parental support are crucial in promoting self-sufficiency in education. The more vital link between ICT skills and parental role can be attributed to the increasing importance of digital literacy in modern education. Hori (2021) asserts that ICT skills are becoming increasingly indispensable for self-directed learning in diverse educational environments. However, the significant influence of the parental role suggests that family support remains a crucial component, even as technology becomes more prevalent in education.

The research discovered that combining ICT skills and parental involvement explained 44% of the variance in learning independence. This statement aligns with the current endorsement of comprehensive strategies in the field of educational technology. It also aligns with the findings of Kormos (2023), who recommended comprehensive strategies to tackle the digital divide. Our study provides empirical evidence that substantiates their theoretical framework, demonstrating the importance of considering both technological and social factors in promoting self-directed learning. Our focus on North Maluku contributes to the growing research on educational resilience under challenging conditions. The significant impact of both ICT skills and parental participation in this setting of a group of islands provides quantitative evidence to support the qualitative findings reported by Daniella (2021) and Young (2019), who studied educational resilience in similar

regions. Our research findings offer conclusive evidence for the qualities that boost resilience in these unique educational settings.

This study improves upon prior research by providing a quantitative perspective in a field that is often dominated by qualitative approaches. While other studies, like Niraula et al (2023), have used qualitative methods to explore how limited internet access affects the development of ICT skills, our quantitative findings enhance the generalisability of these study results. Furthermore, the comprehensive evaluation of ICT skills, including proficiency in internet surfing, software applications, and digital troubleshooting, offers a more nuanced understanding than studies that focus exclusively on basic computer operations. This study validates and broadens the existing research on ICT skills, parental involvement, and the cultivation of self-directed learning. Through a focused analysis of the unique conditions in North Maluku, we provide valuable insights into the interaction of these factors in regions that lack advanced technology and are located on islands. The research findings offer a more comprehensive comprehension of the variables that impact the development of self-reliance in learning. These findings have significant ramifications for educational methods and policies in similar circumstances. This research fills a gap in the current literature on archipelagic regions. It provides a solid foundation for future studies examining the intricate relationships between technology, family support, and scholastic independence in many global settings.

#### 4. CONCLUSION

The study findings suggest that information and communication technology (ICT) skills and parental involvement are significant factors determining a student's ability to learn independently. Collectively, these characteristics explain 44% of the variance in learning autonomy. The study revealed that ICT abilities were a strong indicator ( $\beta = .464$ ,  $p < .001$ ) of supporting autonomous learning practices, especially in areas with limited technology resources. It highlights the importance of digital literacy in fostering independent learning. The influence of parental role on the educational process is significant ( $\beta = .295$ ,  $p < .001$ ), emphasizing the long-term importance of family support, particularly in contexts where access to technology is limited. These findings have important implications for educational policy and practice in regions with a high concentration of islands and other communities lacking technological access. To Foster learning independence, it is recommended that students' ICT skills be enhanced through targeted educational programs and upgraded technology infrastructure. Furthermore, engaging parents and providing them with techniques to assist their children's education in technology-enhanced settings proficiently is recommended. This study builds upon self-efficacy and ecological systems theory concepts by applying them to ICT skills and parental involvement in challenging technological situations. It enhances the theoretical comprehension of cultivating self-reliance. While this study provides intriguing insights, it is crucial to recognise its limitations: cross-sectional design and reliance on self-reported measurements. In order to further research in this field, it is recommended to prioritise performing longitudinal studies to demonstrate causal relationships, employ mixed-methods approaches to gain a complete understanding of the underlying mechanisms, and carry out comparative studies in other archipelagic or technologically disadvantaged areas. Despite many limitations, this study offers a valuable understanding of the complex correlation between ICT abilities, parental engagement, and self-directed learning in challenging educational settings. This study provides a foundation for developing targeted interventions to enhance self-directed learning in comparable international settings.

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#### AUTHOR'S CONTRIBUTIONS

All authors has a significant contribution in writing this manuscript. Dana Arif Lukmana as the first author have responsibility to conceptualize the study, constructed the methodology, and arranged the data analysis. Nursin Sapol as the second author conducted the literature review and composed the preliminary draft of the manuscript. The third author, Ulfa Maulida contributed to do some essential revisions and assisted to final editing of the manuscript, thereby improving its clarity and coherence.

#### CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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