

# The Impact of Information and Communication Technology Literacy on Indonesian Student's Achievement

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**Abstract**—Information and communication technology (ICT) has become an inseparable part of life, including in the field of education. This research aims to determine whether information and communication technology literacy has an impact on students' achievement. Information and communication technology literacy, in this case, refers to the availability of ICT facilities, the usage of ICT in learning, and regulations in schools related to ICT. Participants in this research were senior high school (SMA) students who participated in the 2019 National Examination (N=52,897). Multivariate regression analysis was carried out to find out the impact of information and communication technology literacy on student achievement in the form of national examination scores in Bahasa Indonesia, English, and Mathematics subjects. The results of the analysis show that the availability of information and communication technology facilities and its usage as learning tools can improve students' achievement. However, students' achievement will decline as restrictions on the usage of information and communication technology in schools are too strict. This is possible considering the usage of technology in the 21st century has become a necessity.

**Keywords**—ICT literacy, national examination, student's achievement, school regulation

## I. INTRODUCTION

Information and Communication Technology (ICT) plays an essential role in society, ranging from social, economic, to cultural aspects [1]. The Ministry of Communication and Information, through the Regulation of the Minister of Communication and Information Technology Number 23, defines ICT as all activities related to processing, management, and delivery or transfer of information between tools/media. Meanwhile, Munir [2] stated that ICT is a tool to get additional value in producing fast, complete, accurate, transparent, and up-to-date information. Refers to the ICT, as described, it is not surprising that ICT is very influential in various aspects of life.

Several studies have suggested that ICT contributes to universal access to education [3], equality in education,

delivery of quality learning and teaching, professional development of teachers [4], management, governance, and more efficient educational administration [5]. Semenov [6] said that learning activities carried out by teachers through the use of ICT in a well-designed, integrated, and regularly provide benefits. For example, it facilitates learning for students with various learning styles and abilities and makes learning activities more effective because some of the learners' senses are activated during learning activities. According to Khan et al [7], ICT has brought significant changes in education scope because it is proven to attract students' attention effectively. Meanwhile, Okoro and Ekpo [8] stated that ICT has the potential to encourage students to interact more intensely, improve their learning methods, improve and deepen their abilities, enhance learning experiences, and utilize their skills. Thus, ICT literacy is also an essential part of education.

ICT literacy is defined as the use of digital technology, communication tools, or networks to access, manage, integrate, evaluate, and create information to function in a knowledge society [9]. ICT literacy can also be defined as using information technology to seek and collect information, evaluate information, modify (analyse and create) the information, and communicate ideas [10]. Meanwhile, Erstad [11] briefly states that ICT literacy combines technological literacy with information literacy. Technological literacy refers to an understanding of digital technology, including technical capabilities. Information literacy focuses on knowledge, such as the ability to map, identify, process, and use digital information optimally. In other words, ICT literacy can be interpreted as an ability to utilize digital technology and communication tools to create and manage information so that it can be used to contribute to society.

In education, ICT literacy often associates with the availability of ICT facilities, its usage, and regulations applied in schools. There are several studies related to ICT literacy in education. For example, the results of Balanskat's research in 2006 show that schools with good ICT facilities have a greater chance of producing high-achieving students [12]. In terms of

the learning process, Bingimlas's [13] research shows that the availability of ICT facilities, especially computers, is very influential in learning processes. Other research by Suhawoto [14] underlines that teachers' competence in managing learning by utilizing ICT is the key to the changes in the education paradigm. According to Siahaan [15], teachers will be more focused on carrying out their daily tasks if they are trained and guided on the use of ICT, equipped with ICT facilities in schools, and supported by the network infrastructure and the availability of professionally developed learning materials.

A crucial aspect of learning in the global era is internet service. Especially in a pandemic situation like nowadays, the availability of devices (such as computers or smartphones) and the internet is crucial. Research by Austin and Totaru [16] and Cahyo et al [17] show that students who use the internet wisely and well-controlled can significantly improve their academic performance. On the contrary, students who frequently use the internet for social media and entertainment purposes tend to be uncontrollable. Using the internet for social media and entertainment purposes culminate in wasting time, neglecting school tasks, and decreased learning outcomes [18].

Control over the use of the internet or ICT, in general, can be done individually or by establishing regulations in schools. Unfortunately, in Indonesia, besides the unequal availability of ICT facilities, some schools tend to limit and even prohibit the usage of ICT devices (especially smartphones) at school. Some previous research has shown that ICT facilities can help students' learning processes to achieve better performance. ICT provides so many learning resources that can unify various knowledge [19]. Miarso's research results in Kariman and Mulia [20] also found that ICT, as a media, can improve learning quality. The use of ICT media can eliminate communication barriers, distance and time limitations, and encourage students to be more actively involved. The accumulation of these influences will undoubtedly lead to an increase in students' academic achievement, which represents the quality of output.

Most previous researches on ICT have focused on the use of ICT devices. Research related to the impact of implementing ICT-related regulations on student achievement is still rarely done. Therefore, this research will investigate the impact of the availability of ICT facilities, its usage, and its related regulations on high school students' academic achievement.

## II. RESEARCH METHODS

The secondary data were used in this study. The data were carried out through the 2019 National Examination. The participants in this study were Indonesian senior high school (SMA) students who participated in the 2019 National Examination. In the 2019 National Examination, students were asked to take two tests, i.e., cognitive tests (Mathematics, Bahasa Indonesia, English, Natural Science and Social Science) and some questionnaires, one of which is the ICT literacy questionnaire.

In the ICT literacy questionnaire, several questions must be answered. For example, are there ICT devices available at school and at home? How often do they use ICT to do assignments and find out learning materials? How often they find information on the internet about general knowledge or phenomena that occur today? Do they agree that students should not use smartphones in class? Etc.

Firstly, we obtained the data of 99,615 senior high school students who participated in the 2019 National Examination and filled out the ICT literacy questionnaire. However, since there were several empty responses, we only used the filled-in responses. Finally, we obtained 52,897 student's responses (female=59.6%, public school=57.8%).

To investigate the impact of ICT literacy on student's academic achievement, we used the multivariate analysis of variance (MANOVA). In this study, only Mathematics, Bahasa Indonesia, and English scores were analysed as dependent variables.

## III. RESULTS

Table 1 shows the responses to questions on the availability of ICT facilities at school and the mean of Mathematics, Bahasa Indonesia, and English scores. The results—both on Mathematics ( $F=136.59$ ,  $Sig=0.000$ ), Bahasa Indonesia ( $F=217.56$ ,  $Sig=0.000$ ), and English ( $F=212.50$ ,  $Sig=0.000$ ) scores—show that there were significant differences among group means. Students who have more ICT facilities at school, get higher scores in Mathematics, Bahasa Indonesia, and English than students with limited ICT facilities.

TABLE I. THE AVAILABILITY OF ICT FACILITIES AT SCHOOL

Unavailable	N	Mean		
		Math	Indonesian	English
	1492	34.67	61.60	45.36
1 facility	7368	35.72	63.98	47.05
2 facilities	32749	37.31	67.73	49.51
3 facilities	11288	39.28	68.72	52.78

Table 2 shows the responses to questions on the availability of ICT facilities at home and the mean of Mathematics, Bahasa Indonesia, and English scores. The results—both on Mathematics ( $F=1937.08$ ,  $Sig=0.000$ ), Bahasa Indonesia ( $F=2087.92$ ,  $Sig=0.000$ ), and English ( $F=4570.75$ ,  $Sig=0.000$ ) scores—show that there were significant differences among group means. Students who have more ICT facilities at home, get higher scores in Mathematics, Bahasa Indonesia, and English than students with limited ICT facilities.

TABLE II. THE AVAILABILITY OF ICT FACILITIES AT HOME

Unavailable	N	Mean		
		Math	Indonesian	English
	3247	32.48	56.88	40.11
1 facility	22342	34.02	63.29	43.42
2 facilities	17678	38.50	70.12	51.69
3 facilities	9630	45.09	74.66	64.12

Table 3 shows the responses to questions on the usage of ICTs as learning tools and the mean of Mathematics, Bahasa Indonesia, and English scores. The results—both on Mathematics ( $F=382.44$ ,  $Sig=0.000$ ), Bahasa Indonesia ( $F=662.96$ ,  $Sig=0.000$ ), and English ( $F=744.34$ ,  $Sig=0.000$ ) scores—show that there were significant differences among group means. Students who often use ICT as a learning tool get higher scores than students who rarely use it. However, students who use it too often, get lower scores.

TABLE III. THE USAGE OF ICTS AS LEARNING TOOLS

	N	Mean		
		Math	Indonesian	English
Never	2194	32.19	55.22	39.94
Rarely	7172	33.66	61.72	42.72
Occasionally	14832	36.04	66.46	47.64
Sometimes	16137	38.97	69.66	52.35
Often	9796	40.32	70.70	54.79
Every time	2766	39.76	69.06	54.00

Table 4 shows the responses to questions on student's perception of ICT regulations in school and the mean of Mathematics, Bahasa Indonesia, and English scores. The results—both on Mathematics ( $F=211.49$ ,  $Sig=0.000$ ), Bahasa Indonesia ( $F=199.89$ ,  $Sig=0.000$ ), and English ( $F=444.84$ ,  $Sig=0.000$ ) scores—show that there were significant differences among group means. Students who feel very restricted in using ICT in school have lower scores than students who feel that their use of ICT is less restricted. Although students who felt that their use of ICT in school was not restricted at all also had low scores.

TABLE IV. STUDENT'S PERCEPTION OF ICT REGULATIONS IN SCHOOL

	N	Mean		
		Math	Indonesian	English
Unrestricted	951	36.06	60.75	48.41
Slightly Restricted	11355	40.08	69.59	54.70
Restricted	34685	36.93	67.12	48.77
Strictly Restricted	5906	35.57	64.56	46.19

#### IV. DISCUSSION

As the results, the student's academic achievement was affected by the availability of ICT facilities, both at school and at home. Students who have more ICT facilities get higher scores. In this study, we know that most students have adequate facilities at school. However, at least 16.75% of the sample said that the facilities in their schools were minimal or even unavailable. It is possible because the condition of education in Indonesia is not evenly distributed. Some schools in Indonesia even do not have ICT facilities [21].

Apart from the fact that educational facilities in Indonesia are not evenly distributed, the ownership of ICT equipment is also low. About 48.4% of Indonesian students in this study

admitted to having only one ICT device at home, even though some of them did not have it at all. According to Statistics Indonesia's data in 2019, 63.53% of population aged five years and over, own cellular phone, 14.47% of the population used computer, and 47.69% of the population has accessed the internet in the last three months [22].

The availability of ICT facilities for students is related to its usage. Students can use ICT facilities for entertainment, learning, socializing, and so on. Students who often use ICT as a learning tool get higher scores than students who rarely use it. However, students who use it too often, get lower scores. It is because they may be distracted for doing anything else besides learning, like playing a game or social media.

In this study, around 5.2% of students used ICT as a learning tool all the time. It will be dangerous because they can become addicted to technology if its usage is not regulated. Besides, excessive use of ICT, even for learning, can cause various kinds of mental and physical health problems [23]. Therefore, the use of ICT, especially in schools, needs to be regulated.

As mentioned in the research results, restricting, or regulating the usage of ICT in schools can make students get high scores. These restrictions are must be carried out moderately, not too strict, or even unrestricted. Unrestricted (or unregulated) use of ICT will make students arbitrarily use it so that it will affect student achievement. The strictly restricted usage of ICT will also limit students' learning and will have an impact on student achievement.

#### V. CONCLUSION AND RECOMMENDATION

According to the results, the student's academic achievement was affected by availability of ICT facilities (both at school and at home), ICT usage profile, and school regulation related to ICT. Most students have at least one of the ICT facilities and students who have more facilities get higher scores than students who have less or do not have them at all. Another finding reveals that the use of ICT facilities as a learning tool helps students to get better grades. Furthermore, restrictions on the use of ICT at schools lead students to get lower scores. Based on these findings, we suggest some recommendations to be considered in improving students' learning achievement. Firstly, we recommended teachers and parents to encourage them to optimize their usage on use ICT devices proportionally both for learning purpose as well as for entertaining purpose. Secondly, we encourage teachers and parents to supervise their usage of ITC facilities wisely, so it will not negatively impact their learning achievement. The final recommendation comes to the government to improve and distribute ICT facilities for schools equally all over the country.

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