A STUDY OF ICT INFRASTRUCTURE AND ACCESS TO EDUCATIONAL INFORMATION IN THE OUTSKIRTS OF MALANG

Hakkun Elmunsyah

Abstract: This study aimed to determine the readiness of disadvantaged areas in support of Electronic School Books (BSE), which could be downloaded free of charge by making use of Information Communication Technology (ICT). The present study was descriptive research which was approached quantitatively, and expected to expand the model of development of educational information access facilities and equitable access to education for elementary and high school students and the community in a remote district. This development was a model of media access to information and learning modules managing, accessing and processing information on education. The results indicated that (1) the major constraint factor in the development of information access to education for elementary to middle school in the coastal areas of Malang is power supply, with nearly 90% of electricity under standard compliance, and (2) the knowledge about electronic school books published free of charge by the Department of National Education was lower than their knowledge about computers and internet. Some suggestions based on the above findings were stated.

Key words: Education, electronic school textbooks, ICT, model of development of information access.

1. Introduction

The development of ICT (Information, Communication and Technology) has provided greater opportunities to improve the quality of education in Indonesia by increasing the quality of educators and teachers. The application of ICT in education has been one of the best solutions for teachers to make teaching and learning processes more interesting, effective and efficient. For this reason, it is essential that primary and secondary education make good use of ICT.

Nowadays the term 'ICT' has been widely used in various contexts in daily life. The prevalence of cell phones and internet in the community has boosted the popularity of this term. Some magazines and tabloids about them were even published, indicating the great dependence of the community on these two forms of ICT. Taking the above facts into accounts, the government has made some relevant policies about ICT. To many, these policies seem to involve mostly technology and have little to do with information and communication. As a result, the community also becomes less involved. This should cause great concern because eventually it is the community who will be directly affected by the policies.

The development of ICT and the global information infrastructure has brought significant changes in the way people live their life in many aspects [1]. One of the important aspects that has undergone changes is education. Educators benefit a lot from ICT by using it to improve the teaching and learning process in the classroom and to support the management of education.

To date, teachers have made serious attempts to incorporate the ICT into their classes, expecting betterment in learning outcomes. As a matter of fact, the application of ICT in the pursuit of knowledge at schools could be an alternative solution for them to make learning more interesting,

effective and efficient [2]. Consequently, the application of ICT in education, especially at the primary and secondary levels, has been considered indispensable.

Realizing that Indonesia was left behind with respect to the use of ICT in education and this could become a vital issue in making policies about education, The Department of National Education devised a Strategic Plan about ICT in 2005. Through this Strategic Plan, The Department of National Education informed educators and teachers all over the country that the attempts to improve the quality, relevance and competitiveness of education should be made by strengthening several programs, and one of these programs was the use of ICT in education. The concrete activities to realize this program was developing ICT-based educational systems, teaching methods and instructional materials. In addition, the Department of National Education developed the information network system in schools, the infrastructure and the human resources to support the implementation of the program in education management and teaching-learning processes.

Schools which implement ICT should have a clear vision on ICT use, formulate strategic goals, and plan as well as organize the use of ICT well [3]. Additionally, the implementation of ICT in schools requires infrastructure, which is physical assets designed within a system to provide essential public services [4]. The use of ICT in schools, however, frequently faces major obstacles which may hinder its implementation. Miller [5] states that the challenges for schools include limited time that the teachers have, limited access, high costs, unclear vision on ICT use, lack of training and support from superiors, and inaccurate evaluation results. In the Indonesian context the obstacles that may inhibit the implementation of ICT in the schools located in remote areas are: (1) inefficient management of infrastructure, (2) monopoly of the government in managing the infrastructure, and (3) limited funding (especially in the initial investment).

Infrastructure is physical assets which are designed in a system to provide crucial public service, such as infrastructure of information access in education. The infrastructure should be integrated to the other systems—namely social and economic ones—in the natural environment, as depicted in Figure 1.

Figure 1. *The Relationship between Infrastructure and Other Systems [5]*

The infrastructures include such public facilities as roads, water systems, sewer systems, solid waste management, drainage, power plants, telecommunication, and others. One aspect of infrastructure is dependent on the others. Some problems may arise when building the infrastructure, namely, (1) inefficient infrastructure management, (2) monopoly by the government in infrastructure management, and (3) limited funding.

To find out the readiness of the schools in the outskirts of Malang to access educational information and make use of the information provided by the Department of National Education, it was essential to conduct a comprehensive evaluation study about it. The present study was expected to obtain empirical evidence of how far the use of the existing ICT equipment could fill the gap of information that occurred in the schools in the urban areas and those located in the outskirts. The research problems could be stated as follows:

(1) How was the infrastructure of ICT available in the schools in the outskirts of Malang?

(2) How was the subjects' knowledge about Electronic School Books?

The study attempted to (1) describe the infrastructure of ICT available in the schools in the outskirts of Malang, and (2) describe the subjects' knowledge about Electronic School Books (ESB) published by the Department of National Education.

2. Model of ICT Implementation

The development of ICT nowadays has been very fast and various aspects of life have accordingly been favorably affected. With respect to ease of use and quality, ICT has developed drastically [6]. Despite the improvement, there have been anecdotal reports that inform the unsuccessful applications of ICT in education contexts. This fact should cause great concerns among educators and stakeholders of education.

The success of ICT applications in schools is determined by three factors, namely, hardwares, softwares and the technology users. Research indicates that the failure in ICT applications results mostly from the ICT users' behaviors [7], [8], [9] and [10]. Morgan [11] supported the empirical evidence by arguing that applications of ICT generally yielded favorable results if the users possessed certain characteristics which prompted good behaviors supporting the use of ICT.
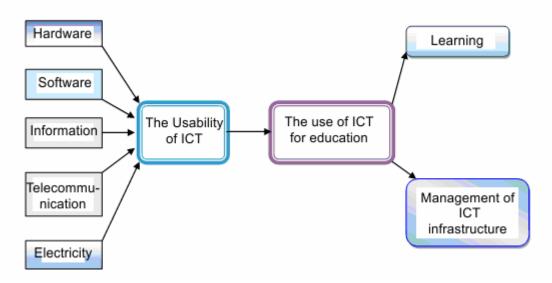

Figure 2. *Conceptual Models in Research [5]*

3. Methodology

The present study was a quantitative evaluative study, using survey as the research design. The population of the study comprised 46 primary and secondary schools in the outskirts of Malang. Two groups of sample were drawn randomly from population. The first group of sample consisted of 46 teachers of the schools mentioned above. One teacher was drawn randomly from each school, resulting in 46 teachers as the sample. The second group of sample consisted of 50 subjects. Ten students were drawn randomly from each of these schools: elementary schools (ES), junior high schools (JHS), senior high schools (SHS), and vocational high schools (VHS). In addition, 10 members of the community (C) around the schools were drawn randomly to be included in the second group of sample. The total number of subjects in the second group was fifty.

The instruments of the study were questionnaires. There was one questionnaire to collect data about ICT infrastructure from the first group of sample, and another to collect data about the users' knowledge about ICT from the second group of sample. The data of ICT infrastructure consists of five components: (1) hardware, (2) software, (3) brainware, (4) netware, and (5) dataware. The data of knowledge about ICT consists of three components: (1) knowledge about computers, (2) knowledge about internet, and (3) knowledge about Electronic School Books (ESB). These two types of data were

obtained by means of questionnaires which used five-point Likert scales with the following options: "very familiar" = 5, "familiar" = 4, "moderately familiar" = 3, "unfamiliar" = 2, and "very unfamiliar" = 1. The questionnaires were handed directly to the respondents.

Before the questionnaires were administered to the respondents, a try-out was conducted to estimate the validity and the reliability of these research instruments. There were 50 try-out subjects who completed the questionnaires. Afterwards, the results were analysed by using *SPSS 16.0 for Windows Evaluation Version* to compute the validity and reliability coefficients.

The validity of the questionnaires was considered acceptable if the value of the *Corrected Item-Total Correlation* is lower than 3.0, whereas the reliability of the questionnaires should be at least .70 [12]. The *Corrected Item-Total Correlation* of the items was between .58 and .94 so it could be concluded that the items in the questionnaires had acceptable validity. As to the reliability, the *Cronbach's Alpha* coefficient was .992, indicating that the questionnaires were highly reliable.

4. Results and Discussion

4.1 ICT Infrastructure

In general, it was found that access to information had been widely available in all six counties by making use of Wi-Fi (through antennae or mobile phones) or fixed phones. The technology of internet access in the outskirts of Malang was provided by the mobile phone operators, Internet Service Providers (ISPs) and telecommunication companies which offered fixed phone services. The relatively wide availability of internet access in those areas, however, was not supported by the sufficient power supply. Many schools—especially the primary schools located in the coastal areas—could only afford low-voltage power supply so that it was hardly possible to develop ICT infrastructure there.

The results of analysis indicated that out of six counties in the outskirts of Malang, Donomulyo turned out to be the one which was the most potential to be developed because it obtained the highest scores in most of the major aspects of ICT infrastructure (Figure 3). Although the brainware (teachers) might be less prepared and the internet access was a little slower than the other counties, Donomulyo exceeded the other counties in terms of electricity power, learners and hardware.
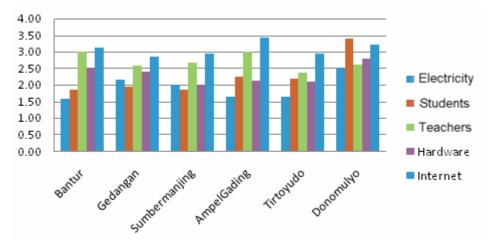

Figure 3. *The Eligibility of ICT Infrastructure in Five Counties*

Ampelgading ranked the second in the list of potential counties, having the best internet connection and technology-savvy teachers and students despite being underprepared with respect to hardware and electricity. The third county where ICT infrastructure could be developed was Bantur, which showed a similar tendency to Ampelgading, i.e. good internet connection and well-prepared teachers and students but lack of sufficient hardware and electric power. Gedangan and Sumbermanjing ranked the fourth and the fifth respectively, indicating similar conditions in terms of electricity, students,

teachers, hardware and internet. Finally, Tirtoyudo was the county which was the least potential area to develop ICT infrastructure because in general it was the most underprepared in terms of the five criteria.

In general, the component that most frequently proved to hinder the implementation of ICT in the outskirts of Malang is the availability of sufficient power in those areas. Out of five counties, four underwent problems in electric power. The results of this survey were consistent with the condition explained by the Minister of Communication and Information in 2008. He stated that the consumption of power in Indonesia was so high that it could become a major problem if the power supply could not cope with the demand. The policies applied by the National Electricity Company obviously indicated that this company had failed to meet the demand for electric power all over the country. For instance, the company released obligation to fund their operational activities in an attempt to meet the need for the electric power in Indonesia in the next 10 years. It indicated that the power supply failed to meet the demand [13].

The survey conducted to rank 46 schools in the outskirts of Malang with respect to their readiness in developing ICT resulted in 1.42 as the lowest score and 4.83 as the highest score (with a maximum score of 5). The average score was 2.65, indicating that in general these schools could potentially develop ICT as an integral part of teaching-learning processes, but only at moderate level. There were only 10.9% schools scoring 1.75, and this score was obtained for the availability of power as elaborated above.

Elmunsyah [5] found that to ensure the system of technology and information ran well several aspects of infrastructure needed to be analyzed: (1) electricity power, (2) computers, and (3) internet access and security in the schools. Additionally, the conditions which support the infrastructure should be well documented, namely (1) the number of students, (2) the quality and the number of ICT teachers, (3) relationship between schools, (4) the facility of internet around the schools, and (5) other equipment in the schools. This is in line with the results of research conducted by UNESCO [15] and the survey based on the theory of information system [16], which found that the development of a particular information system required well-planned procedures to ensure that the system ran smoothly. The information system consists of five major components, i.e. (1) hardwares, (2) softwares, (3) brainware, (4) netware, and (5) dataware.

4.2 Knowledge about educational information

Figure 4 depicts how knowledge about computer and internet related to knowledge about electronic schools books. The subjects consisted of people from five groups: elementary schools, junior high schools, senior high schools, vocational schools and the community around the schools. The results of statistical analysis indicated that the knowledge about the facilities provided by the Department of National Education in the form of electronic school books was below average compared to the knowledge about computer and internet.
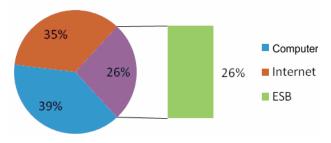

Figure 4. *Subjects' Knowledge about ICT*

While 39% of the subjects possessed good knowledge about computers in general and 35% knew how to access the internet, only 26% of them realized that electronic school books were available to

download free of charge from the internet. Further, analysis of data about the subjects' knowledge resulted in the following:

a. The group factor yielded p-value = 0.000 which was lower than α = 0.05 so Ho : μ_{ES}= μ_{JHS} = μ_{SHS} = μ_{VHS} = μ_C was rejected. It means that those five groups significantly differed with respect to their ability.

b. The factor of knowledge about computer, internet and electronic school books (ESB) yielded p-value = 0.000 which was lower than α = 0.05 so Ho : μ_{SD}= $\mu_{computer}$ = $\mu_{internet}$ = μ_{ESB} was rejected. It means that the five groups have significantly different level of difficulties in their interpretation.

c. The interaction factor yielded F-test value = 1.145 with degrees of freedom (r-1)(c-1) = (5-1)(3-1)=8 and rc(n-1) = 5x3(10-1)=135. The p-value = 0.337 exceeded α = 0.05 so Ho : $\mu_{ES\text{-}knowledge}$ = $\mu_{JHS\text{-}knowledge}$ = $\mu_{SHS\text{-}knowledge}$ = $\mu_{VHS\text{-}knowledge}$ = $\mu_{C\text{-}knowledge}$ was accepted. It means that there was no interaction between the two factors, i.e. the types of groups and their knowledge.

Further, to find out the difference between groups, the researcher conducted Post Hoc Multiple Comparison using the model of Bonferroni and Sceffe, and the results were reported in Table 1.

Table 1. *Tests of Between-Subjects Effects with Dependent Variable: The Average Value*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	55.994[a]	14	4.000	5.896	0.000
Intercept	1036.378	1	1036.378	1.528E3	0.000
Groups	23.762	4	5.940	8.758	0.000
Knowledge	26.017	2	13.009	19.178	0.000
Groups * Knowledge	6.215	8	0.777	1.145	0.337
Error	91.572	135	0.678		
Total	1183.945	150			
Corrected Total	147.567	149			

a. R Squared = .379 (Adjusted R Squared = .315)

Based on the above computation, it was found that:

a. The ability of the Elementary School group was different from the other four groups.

b. The ability of the Junior High School group was different from three groups, namely Senior High School, Vocational High School and Communities.

c. The ability of the Senior High School group was different from the Vocational High School group.

d. The ability of the Vocational High School group was not different from the other four groups.

e. The ability of the Community group was different from two groups, namely Senior High School and Vocational High School.

Since August 2008 the textbooks have been available for download at the website of the Department of National Education, namely, The Website of Electronic School Books (http://bse.depdiknas.go.id). They are also available in the following websites: http://www.depdiknas.go.id, http://www.pusbuk.or.id and http://www.sibi.or.id. Those e-books have been thoroughly reviewed by the Department of National Standard of Education (*Badan Standar Nasional Pendidikan* or BSNP) and the quality of these e-books has been considered as high to be used in teaching and learning at

schools, as shown in the Decree of National Education Ministry Number 46 in 2007, the Decree of National Education Ministry Number12 in 2008, the Decree of National Education Ministry Number 34 in 2008 and the Decree of National Education Ministry Number 41 in 2008. As the copyright of the e-books is owned by the Department of National Education, the e-books can be reproduced, printed, photocopied, stored in various media, and/or traded by individuals, groups of individuals and/or organizations to ensure convenient access and reasonable prices.

However, the findings above showed that the many in remote areas in Malang had not known that the Department of National Education provided free school e-books that could be downloaded for educational purposes. This explained the fact that their knowledge about the electronic schools books was lower than their knowledge about computer and internet. As a consequence, the town councils in the outskirts of Malang, especially the Education Unit in the town councils, should take necessary steps to fill the gaps in the knowledge about electronic school books to improve the education in these areas.

3. Conclusion

The results of the survey in the outskirts of Malang indicated that none of the schools there met the criterion "very potential to be developed" in terms of ICT. On the scale of 0 to 5, in average the schools included in the survey scored 2.78, which could be categorized as "moderately potential to be developed." Consequently, the schools in the remote areas in Malang could possibly improve the use of ICT and develop the relevant facilities to increase access of educational information provided by the Department of National Education.

The major obstacle in developing access to educational information in both primary and secondary schools was the insufficient power supply. Almost 90% of the schools were provided with substandard power supply. Some mobile phone operators provided the link-to-internet programs which proved to be beneficial for the schools' use of ICT in remote areas, especially in Donomulyo, where internet providers were not yet available.

The five groups of respondents knew the information about programs of the Department of National Education, especially Electronic School Books, in various degrees, with 42% of them "not know at all", 28% "not know", 20% "moderately know", 10% "know" and 0% "know very well." The results of Post Hoc Multiple Comparison analysis using Bonferroni and Scheffe method demonstrated that the knowledge about electronic school books was influenced by the knowledge about computer and internet possessed by respondents in the five groups.

It is strongly recommended that all activities related to the use of ICT be evaluated. First, the Education Councils need to apply relevant strategies to establish Local Area Network (LAN) for the infrastructure of ICT network so that one school can be connected to integrated to another. This will pave way to develop Wide Area Network (WAN). Second, the Education Councils should do intensive coordination and cooperation with relevant educational institutions to gather the necessary information and to write reports using the same format. This will enable constructing a synergic, integrated system of data that can be shared by all schools. Third, the need for good hardwares, softwares and brainwares has been increasing so ICT network between one school and another should be made optimum to avoid inefficiency. Fourth, good management is a must to overcome the obstacles—especially related to telecommunication—faced by the schools in the outskirts of Malang and avoid conflict of interestsamong the parties involved. Fifth, the schools need to establish cooperation with tertiarty educational institutions and ICT experts so that they can receive relevant supports about the implementation of ICT from different points of view, such as environmental and managerial ones. Finally, the Education Councils need to apply relevant strategies to establish network with schools in other towns so that the school in the outskirts of Malang can be integrated to the schools in other areas. In this way, data and contents can be accessed whenever the village councils, the city councils or the government need them.

References

[1] Usluel, Askar, and Bas. (2008) A Structural Equation Model for ICT Usage in Higher Education. Educational Technology and Society.

[2] Jin-Ho Im, Hyun-Seok Lee, & Hyoung-Ju Kim. (2005). *Analysis of the Effectiveness of ICT use in Education - focusing on affective domains*. Korea Education & Research Information Service. Accessed in http://english.keris.or.kr /ICSFiles/afieldfile/2006/06/ 08/rnd.pdf.

[3] Schreurs, J. (2007). *ICT use in school: vision and performance measures*. Villach-Austria: Procceding Conference ICL-2007.

[4] Setyaningsih, M. (2008). *Analisa Kebutuhan Komputer tahun 2008 di Surabaya*. BAPETIKOM.

[5] Miller, L.W. (1997). Computer Integration by Vocational Teacher Educators. *Journal of Vocational and Technical Education 14*(1).

[6] Jogiyanto. (2007). *Sistem Informasi Keperilakuan*. Penerbit ANDI.

[7] Adams, D.S., R.R. Nelson, and P.A. Todd. (1992). Perceived Usefulness, Perceived Ease of Used, and Usage of Information Technology: A Replication. *MIS Quarterly*, 16 (2):227-247

[8] Iqbaraia, M., Zinatelli, N., Cragg, P., and Cavaye, A.L.M. (1997). Personal computing acceptance factors in small firms: A structural equation model. *MIS Quarterly, 21*(3):270-305

[9] Jantan, M., T. Ramayah, Chin Weng Wah. (2001). Personal Computer Acceptance by Small and Medium Sized Companies Evidence from Malaysia. *Jurnal Manajemen danBisnis*, 3(1): 199-216.

[10] Ramayah, T., Christine Ong Swan dan Jasman J. Ma'ruf. (2004). Faktor-Faktor yang Mempengaruhi Tahap Penerimaan Teknologi Informasi di Kalangan Industri Kecil dan Menengah di Utara Semenanjung Malaysia: Suatu Kajian Awal Aplikasi Technology Acceptance Model. *Jurnal Ekonomi dan Bisnis*, 3 (2), 171-194.

[11] Morgan, (1996), Developing academic library skills for the future, *Library Review 45* (5): 41-53.

[12] Elmunsyah H., (2009), *Pengembangan Model perluasan dan Pemerataan Akses Pendidikan dalam Mensinergikan Kebijakan Depdiknas pada Implementasi Program BSE di Daerah Pegunungan Kabupaten Malang*, Kemendiknas.

[13] Ary, Jacobs, & Razavieh, (2002). *Metode Penelitian Kualitatif* (5th ed.). PT. Remaja Rosda Karya.

[14] *Damayanti, D.* (*2008*), Reorganize the State Electricity Company, *Library of Bappenas.* Accessed in http://*b2te.bppt.go.id/journal0211.pdf*

[15] UNESCO. (2004). *Schoolnet Tool Kit*. UNESCO Asia and Pacific Regional Bureau for Education.

Authors

Hakkun Elmunsyah, Department of Information Technology Education, Faculty of Engineering, Malang State University, Malang, Indonesia, e-mail: hakkun@um.ac.id.