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The Effort to Optimalize the Utilization of ICT for Learning and Education Using the Multilevel Factors Approach

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Abstract: The sustainability of the implementation of ICT utilization in a comprehensive education system is essential. The implementation requires a continuous monitoring and evaluation in order to achieve progress of the educational institution in accordance to its vision. This research aims to examine the factors of tiered input domain to the utilization of ICT that affect the quality of education. The descriptive and verificative Methods are used while the 2.394 students and lecturers of the Faculty of Economic and Business of UNIKOM are taken as the analysis unit with research sampel (with confidence level of 99%) of 521 students. The results shows that the quality of education as the demands of the stakeholders could be increased through a comprehensive and effective optimalization of of ICT's utilization by considering the multi-level factors affected it such as cultural organization, institutional policy, the quality of infrastructure and the quality of human resources.

Key words: Cultural organization, institutional policy, the quality of infrastructure, the quality of human resources, the effectiveness of ICT's utilization, the quality of education

INTRODUCTION

The dynamics of the ICT developments as well as the demand of the student's competency that fit in the needs of market makes the utilization of ICT in education is no longer an option but becoma a consideration for educational institutions. This becomes the reason to make the ICT as the main components in teaching and learning process so as the educational system is able to fulfill the demand of society in providing its alumnus.

According to Kozma (2005), giving attention as well as decision to invest in ICT for educational institutions in order to enhance the quality of education is to support the development of economy especially to develop the quality of human resources and increasing the labor's productivity. Kozma (2005) argues that ICT is used in education to develop education such as the revision in curriculum, pedagogical shifting or the change in values as well as to support the management and the accountability of education. According to the reports of ImaCT2 in 2002, the results of the research shows that ICT statistically aims to the improvements of education. The utilization of ICT by students giving high correlation. Furthermore, the study conducted by Ramboll Management on e-Learning shows that all stakeholders such as student, teacher, parents and the chairs of educational institutions are convince that ICT has positive impact on learning and learning methods of students. OECD (2008) states that the quality of ICT's utilization is focused more than the quantity in determining the contribution of the student's success. Hence, it needs to answer the question of "how" in order to enhance and optimize the utilization of ICT in educational process.

ICT plays important role in order to formulizing the teaching strategy for the students as well as it is used as a tools to support the educational process. ICT is also an integral part of educational activity as well as to support other factors in education. It aims to provide sollution for a challenge of a good and well organized educational system. This drives us to focused on digital competency in educational curriculum. The most important thing is the commitment of lecturers and student to applies the ICT optimally in every aspects of education. Needs is required in the development of indicators that can capture a more systemic development on ICT in education and how the learning system implement and use the ICT (Erstad, 2005).

According to Kozma (2003), the strategy to make serious effort to optimize the utilization of ICT needs sollution from various field: a communication networks that needs sufficient infrastructure an enhancement of the lecturer's expertise in utilization of ICT for the prpose of educational process, technical administration, educational curriculum and pedagogical approaches that fit to the use of ICT in learning as well as the content development that

needed in facilitating the ICT. The consequence is that it is need various elegant and sustainable approaches with the combination of both quantitative and qualitative methods.

The measurement of the success of the utilization of ICT in improving the quality of education needs a clear and informative criteria in order to gain a good evaluation and monitoring by both educational institution and users in the end of educational process. Cabrol and Severin states that the main challenge in ICT's utilization is a proper indicator to make appropriate decision for the monitoring and evaluation processes that should be put in the integral part of the process of ICT's utilization in education.

The limitation and challenge in the utilization of ICT in education shows that there is a substantial challenge in building the information system by involving various actors at different level in educational system. It also shows that building an information system has its own limitation in relation with the initial purpose and ambition from the level of policy on the implementation of information system. The challenge faced in this particular case is the culture inside the organization such as the custom of the member that needs changes in order to fit in different system. For fome lecturers for exampl that are accustomed to use a "manual" system in their teaching without any involvement of technology or information system that has been built are not easily change in accordance with the expectation of the top management. In addition, the online activity is also has not been fully exploited in educational process. This eventually needs motivation in form of strict instruction from the top management to change the thinking paradigm in doing the teaching process.

Another challenge is the infrastructure that not directly proportional with the acceleration of the development of information system. This happen since it is not an easy task to make a major investment in developing the system. Top management argues that the technology owned by institution is still able to support the information system built. Nevertheless in utilizing the information system it is needed not only the commitment from the top management but also the commitment from the entire organization to have a common purpose. According to Scheuermann, various researches have been conducted but none of them giving a vivid information on the various effects and impact of ICT to the learning process as well as to the students. There is still a question has not been answered on the impact of technology in the short and long-term on the learning process and how the ICT affect a simple and complex learning task.

Discrepancy identifies in assessing the impact of ICT particularly in satisfying the stakeholders that aims to define the strategy based on evidence and the policy measures in implementing the ICT an effective and efficient manner in the utilization of resource. Scheuermann argues that there is still a shortage of a comprehensive study on complex interaction between various implementation of ICT and other factors affected it such as school intervention, social status, economy and cost.

Multilevel factor that reinforcing or weakening the utilization of ICT in order to enhance the quality of education could be viewed from various level. According to Erstad the factors used viewed from nationwide level, local, institution, the competency of teacher, the level of learning environment, collective level as well as individual level. Therefore, this research uses the conceptual framework from all three level in utilizing the ICT to improve the quality of education which is every level involves in input domain, process and output. This gives impact on the level of progress of educational institution in implementing the utilization of ICT in its comprehensive educational system.

Research aims: Based on the explanation above, this research aims to analyze on the conceptual framework study of the utilization of ICT in improving the quality of education by using a quantitative data. Thus the statistical results will be obtained that the conceptual framework of the utilization of ICT is shown to have an influence on the quality of education seen from some of the factors that influence it.

Literature review: Based on the integration conceptual framework of the utilization of ICT in education in this research the element in ICT integration is being separated in order to find out the factors affect the utilization of ICT. This factor is the input domain factor beyond the measurement of the utilization of ICT:

- The culture of organization (Erstad, 2004; Rijal, 2016; Weng and Yang, 2016)
- The policy of institution (Erstad, 2004)
- The quality of ICT's infrastructure (Erstad, 2005)
- The quality of human resource (Erstad, 2005)

These factors can be explained as follows

The culture of organization: In conceptual framework, the culture of organization lies in the insitution level. The

indicator to measure the culture of organization according to Erstad (2005) consist of leadership style, the lecturers community and the population of students.

The policy of institution: In institutional level, according to Erstad (2005), the policy of institution is measured by several indicators such as: planning (priority of project), budgets, the legal framework and incentives. Planning concerning the priority of projects (short or long-term) in other context it is concerning initiatives, planning, projects or actions, including visibility (understood as the ownership level with success and their goals to lead this project).

Meanwhile, budgets is divided into long-term budgets that needs to preserve the continuance and the development of complementary initiative in order to the achieve the success of operational project. Legal framework is measured by the actions to adjust to the rules and regulations to increase and improve the impact of initiatives and minimizing risk, including the steps to increase the safety and security of underage children, regulations related to the industry and copyright protection. Moreover, initiative is related with planning and program designed to (positive or negative) underline the commitment of recipient and the result of the project expected by members.

According to Scheuermann the indicator of this process domain encompassing cost of investment, training and including the inclusion of ICT into the curriculum. Additional measurement according to Erstad (2005) including the ability to collaborate as an indication on how the utilization of ICT is able to stimulate a collaborative work between students, it is also related to the teaching method and strategy that are documented to provide direction and indication of changes.

The quality of ICT's infrastructure: The quality of infrastructure is included in institutional level. Scheuermann states that the indicators of infrastructure are hardware, software and ICT access. According to Cabrol and Severin, the indicators of infrastructure are the ICT curriculum, tools (productivity application, virtual simulator and modeling) and information system. Furthermore, according to Carol and Severin infrastructure is measured by the availability of facility, both in form of particular reference on the characteristic of technical equipment.

The relation between the characteristic of product and particular reason to select the equipment, distribution and the final characteristic of the equipment, including the connection with other equipment that indirectly related to the success of the project as well as the characteristic of the condition of connection.

The quality of human resource: The quality of human resource is divided into lecturer's competency level and student-individual level (Erstad, 2005). On the level of lecturer's education, the indicators are the measurement of the lecturer's competency on ICT and pedagogical support. This becomes the basis of ICT literacy indicator and how the lecturers are ready to encounter the challenge in educational process.

The student-individual level is measured by knowledge building, problem solving: how ICT stimulate to build knowledge and problem solving for the students by assessing on the performance and ICT competency. The differences of ICT competency of the students is the digital discrepancy. According to Cabrol and Severin the elements included in student-individual level is the learning process of the student. The utilization of ICT aims for the students to gain a direct benefit. Then it is the educational support system. The mechanism is intended to motivate and lending support to the work of stakeholders involved in the project such as assistance, online, training resources, mutual communication between colleagues and guide the resulting output. According to Cabrol and Severin the student's commitment is one of the fundamental component in educational process. A sustainable motivation and participation of the student are needed to make the project successful and have a positive impact not only to the results of study and the development of new competency but also to the learning environment, the expectation of stakeholders and the enchancement of the students's "level". The Attendance data, repetition, the pro and the drop out rate and to facilitate the performance of a direct impact analysis.

The utilization of ict: The framework in education in its relation to ICT is the level of digital literacy (Erstad, 2005). The digital literacy is related to the ability to utilize ICT to achieve goals. According to David Reinking digital literacy is related to the transformation of the traditional culture technique (read and write) to become a competent reader and writer. According to Rassool (1999), digital literacy defined as an actor transformation in their way to deal with the change of environment in order to gain an understanding of the meaning of learning.

The empowerment associated with an active utilization of digital media which should be based on the condition that the actor has the competence and critical perspectives on how to use it for learning purpose. There are some that have the skills and knowledge of ICT for personal development and there are who not. Educational institutions has the purpose to neutralize the process of changing the traditional culture into the culture in the digital era (digital transformations). The framework of ICT

literacy (Educational Testing Service, 2002) by the US Expert Team for Educational Testing Service identifies the key concept of ICT literacy:

- Basic skills; Be able to open software, sort out and save information on the computer and other simple skills in using the computer and software
- Download; Be able to download different information types from the internet
- Search; Know about and be able to get access to information
- Navigate; Be able to orient oneself in digital networks, learning strategies in using the internet
- Classify; Be able to organise information according to a certain classification scheme or genre
- Integrate; Be able to compare and put together different types of information related to multimodal texts
- Evaluate; Be able to check and evaluate if one has got the information one seeks to get from searching the Internet; Be able to judge the qua- lity, relevance, objectivity and usefulness of the information one has found. Critical evaluation of sources
- Communicate; Be able to communicate information and express oneself through different mediation means
- Cooperate; Be able to take part in net-based interactions of learning and take advantage of digital technology to cooperate and take part in networks
- Create; Be able to produce and create different forms of information as multimodal texts, make web pages and so forth. Be able to develop something new by using specific tools and software. Remixing different existing texts into something new

According to Scheuermann, the indicator of process (utilization) are: the frequency of ICT utilization by lecturer to teach, the frequency of ICT utilization by students to learn, the type of software used in educational process, the method of both lecturers and students in utilizing ICT (teaching, group working), the attitude towards ICT, self-confidence towards ICT, the skill in utilizing ICT, sustainable professional development and students performance.

The model proposed by Moersch (1995) identifies the level of the utilization of ICT: usability, awareness, exploration, infusion, integration, expansion, improvement. This model is focus on what the lecturers and students do in utilizing ICT (average hour utilization per week to learn and teaching). A more recent effort is to use the indicator in ICT integration model in education was made in the context of project by UNESCO Institute Technology of Information was based on assumption that the process last through phases: emerging phase, applying phase, integrating phase, tranformation phase. This model is use to determine the progress of educational institution in implementing ICT.

The quality of education: The quality of education is measured by using the student's performance and the student's continuity in utilizing ICT as well as the acquisition of indirect benefit from society as the user of educational institution as the indicators.

Research model: According to Erstad (2005), it is needed an organizational culture as the factor that could affect the utilization of ICT in education on institutional level. Thus, the hypothesis formulated:

- H_1: The culture of organization reinforce the utilization of ICT in education

Scheuermann states that to monitor the integration of ICT in education, there are factors that affected it such as: ICT infrastructure (hardware, software and internet connection) and ICT access for students and lecturers at home (internet connection). Moreover, Cabrol and Severin argues that the elements of infrastructure in form of ICT curriculum, tools (productivity application, virtual simulator and modeling) and information system are included in ICT utilization's conceptual framework in education. The hypothesis is formulated:

- H_2: The quality of infrastructure strenghtening the implementation of ICT utilization in education

The policy of institution is an institutional factor that could strenghtening the utilization of ICT in educational system as stated by Scheuermann. In order to monitoring the integration of ICT in education, a policy from institution is needed to show the commitment of the leader in promoting the educational system. According to Cabrol and Severin the elements which include in the conceptual framework of ICT utilization in education are planning (project priority), budget, legal framework and incentives. Therefore, the research hypothesis are formulated.

- H_3: The policy gives power to implement the utilization of ICT in education

In relation to human resource, it is an individual level factor that affects the utilization of ICT. According to Erstad (2005) on the institutional level, it is needed the

lecturers competency on ICT as one of human resource quality that the institution must possess as well as an input in form of the quality of the students. Cabrol and Severin argues that the elements which included in the conceptual framework of ICT utilization in education is the human resource in form of training for the lecturers, ICT competency and pedagogical support. Based on these elements the hypothesis is formulated:

- H_4: The quality of human resource influences the utilization of ICT in education

According to Yusuf (2005), the education sector has been influenced by ICT. ICT influences both teaching, learning as well as research. Education is the fundamental factor for each individual in the dynamic of world's development that rapidly changing. The utilization of ICT in educational system drives various aspects of the construction of students knowledge, interesting learning experience so that the ICT plays strategic role in improving learning.

Young (2002) states that ICT enhance the flexibility of education's delivery so that the students can access the knowledge at any time anywhere and wherever. This could influence the way in which the students learn since it is driven by the learning process which in turn would give the students a better preparation to learn over their life as well as to increase the quality of learning. With the help of ITC, the students nowadays could access various source of learning such as e-book, previous journals and also have an easy access to informants, mentors, experts, researchers, professionals as well as colleagues around the world. Thus, ICT plays important role to removes geographical boundaries since the stundent can log in from any place (Bhattacharya and Sharma, 2007).

IST has a potency to remove the obstacles that become the origin of a low quality education in any country. This could also be used as a tools to overcome the problem of cost, lack of teachers and low quality education as well as to overcome the problem of time and distance (McGorry, 2002). Plomp *et al.* (2007) empasize that peoples should access knowledge through ICT in order to follow the latest development. ICT also enable the creation of digital resource such as digital library where both students and lecturers as well as professionals could access various educational literature or course material from any place at any time (Bhattacharya and Sharma, 2007). This kind of facility enable the academic network and researcher to share various scientific materials (Cholin, 2005). ICT also provide opportunity to access various information using several information resources and viewing information

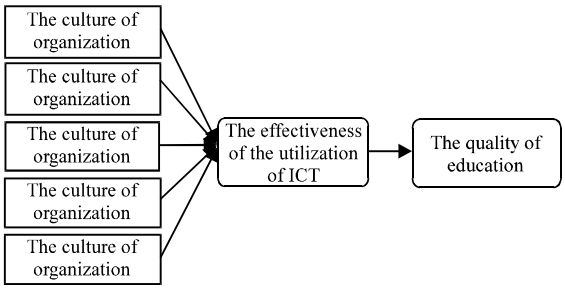

Fig. 1: Research model

from various perspectives so that develop the originality of learning environment. Therefore, ICT could function as a facilitator of an active learning and high level rationalize (Alexander, 1999; Jacolbia, 2016; Kongmanus, 2016). ICT could also function as the tools to differentiate the curriculum, providing opportunity to adapt the learning content and assignment with the needs and ability of each individual students as well as giving appropriate feedback (Smeets *et al.*, 1999; Supratman, 2015; Chadyiwa and Mgutshini, 2015). Based on the previous researches, thus the final hypothesis is formulated:

- H_5: The utilization of ICT increasing the quality of education

Based on the framework that has been presented in the literature review, the research model is then formulated such as presented in the figure below. The culture of organization influence the use of ICT. Agency policy affecting the effectiveness of the ICT utilization. The Quality of Infrastructure affect the effectiveness of the utilization of ICT. Human resources affect the effectiveness of the ICT utilization. The effectiveness of the ICT utilization affects the quality of education (Fig. 1).

MATERIALS AND METHODS

The method used in this research is the Descriptive and verificative methods. The path analysis is used as the statistical analysis. The data used in this research is collected using questionaire from the population of 2344 students and 50 lecturers of Economic and Business Faculty of UNIKOM while sample that used with 99% level of confidence is 521 individuals.

He aim in this hypothesis test is to proves whether there is an influence from independent variables both partially and simultaneously to the quality of education. The type of analysis used to reach the aim of this research is the path analysis by using the SPSS Software as the analysis tools.

RESULTS AND DISCUSSION

Based on the descriptive analysis, the characteristic of each research variable have been obtained: the culture of organization, the policy of institution, the quality of infrastructure, the quality of human resources, the effectiveness of ICT utilization and the quality of education. These characteristics are included in good category. Based on the matrix correlation obtained from data processing using SPSS, the culture of organization has a negative significant impact to the effectiveness of ICT utilization. This result is in moderate category with correlation value between 0.40-0.599. Meanwhile, the other four independent variables have a positive significant impact which included in strong category with correlation value between 0.60-0.799. The correlation between independent variables shows to have a positive correlation that enter both moderate and strong categories.

Based on the calculation of the coefficient of determination of the path analysis, the influence of variables are directly and indirectly can be determined: the influence of the culture of organization (X1), the policy of institution (X2), the quality of infrastructure (X3) and the quality of human resources (X4) on the effectiveness of the ICT utilization (Y) is 67.78% and its implications on the quality of education (Z) is 53.7%, this can be determined by multiplying the path coefficient to the correlation matrix between variables. Below is described the results of the hypothesis testing:

- The influence of the culture of organization to the effectiveness of ICT utilization (H_1). The culture of organization variable (X1) has a significant impact to the effectiveness of ICT utilization (Y) since the t count (2.545) >t table (2.14) (H_0 is rejected)
- The influence of the policy of institution to the effectiveness of ICT utilization (H_2). The policy of institution variable (X2) has a significant impact to the effectiveness of ICT utilization (Y) since the t count (2.265) >t table (2.14) (H_0 is rejected)
- The influence of the quality of infrastructure to the effectiveness of ICT utilization (H_3). The quality of infrastructure variable (X3) has a significant impact to the effectiveness of ICT utilization (Y) since the t count (2.461) >t table (2.14) (H_0 is rejected)
- The influence of the quality of human resources to the effectiveness of ICT utilization (H_4). The quality of human resources variable (X4) has a significant impact to the effectiveness of ICT utilization (Y) since the t count (2.195) >t table (2.14) (H_0 is rejected)
- The influence of the effectiveness of ICT utilization to the quality of education (H_5). The effectiveness of ICT utilization variable (Y) has a significant impact to the quality of education (Z) since the t count (2.265) >t table (2.14) (H_0 is rejected)

The consequence for the educational institution is that it should focus their attention on how the ICT could contribute to the improvement of the quality of education, to improve the utilization of infrastructure based on ITC to develop the Tri Dharma Perguruan Tinggi, to improve the students activity and autonomy for learning purpose as well as increasing the students critical reflection in relation with the utilization of ICT.

The development of curriculum is also become attention since an analysis is needed in order to better understand the methods to learn the impact of ICT on education. This become an observation for the future that oriented to the students competency, both individual as well as collective-institutional competency to transform into a digitally-competent and digitally-mature institution. It is completely understanable if there was any informational discrepancies or incompatibility with the user's needs as well as a lack of lecturers response in reciprocating the change of culture during the early developement of ICT. Thus, after sustainable improvement by involving participations of users, the information system implemented will eventually be able to create improvement and building a clear platform to determine the further level in developing the information system. This become the foundation in building a comprehensive knowledge and learning model through the multilevel approach in order to overcome the complexity by using certain strategy that the department used to act to reach its aims. The educational process also needs to be focused to remain concentrated on the expectation to utilize the online lecture and learning source through digital media. Therefore, ICT will no longer remain as learning supporting tools but become an integral part of the learning process.

Hence, it is essential for the educational institution to focus their attention in improving the quality of education through the improvement of the effectiveness of ICT utilization in learning process in particular and in organizing the education in general. The effectiveness of the ICT utilization is determined by how the members of organization are accustomed to good organizational culture, an institutional policy and the quality of infrastructure that optimally support the utilization and implementation of ICT as well as the quality of human resources that support the implementation of ICT in educational process in order to improve the quality of education.

CONCLUSION

Based on the phenomenon, research aims and the result of the research, it can be concluded that the sollution in overcoming the problem of the quality of education lies in improving the effectiveness of ICT utilization in educational process. The lack of effectivity in utilizing the ICT can be overcome by changing the custom of the member of organization towards good in accordance with the culture expected by educational institutions, formulating the insitutional policy and an improvement in infrastructure's quality that fully support the educational process based on ICT as well as an improvement of the quality of human resources both lecturers and educational staff in eduational institution.

REFERENCES

Alexander, J.O., 1999. Collaborative design, constructivist learning, information technology immersion and electronic communities: A case study. Interpersonal Comput. Technol., 7: 1-28.

Bhattacharya, I. and K. Sharma, 2007. India in the knowledge economy-an electronic paradigm. Int. J. Edu. Manage., 21: 543-568.

Chadyiwa, M. and T. Mgutshini, 2015. Using mobile handheld devices as tools of learning and teaching for student EHPs: A blessing or a curse. Intl. J. Humanities Arts Soc. Sci., 1: 38-44.

Cholin, V.S., 2005. Study of the application of information technology for effective access to resources in Indian university libraries. Intl. Inf. Lib. Rev., 37: 189-197.

Educational Testing Service, 2002. Digital transformation: A framework for ICT literacy. Educational Testing Service, Princeton, New Jersey.

Erstad, O., 2004. PILOTer for skoleutvikling (PILOTs for school development: Final and summary report of the PILOT project. Master Thesis, Oslo and Akershus University College, Oslo, Norway.

Erstad, O., 2005. Digital Literacy in the School. University Press, Oslo, Norway,.

Jacolbia, R.B., 2016. Future educators perceptions on technology and livelihood education status and development of work skills. J. Adv. Humanities Soc. Sci., 2: 85-91.

Kongmanus, K., 2016. Development of project-based learning model to enhance educational media business ability for undergraduate students in educational technology and communications program. J. Adv. Humanities Soc. Sci., 2: 287-296.

Kozma, R.B., 2003. Technology, Innovation and Educational Change: A Global Perspective. ISTE Publisher, Eugene, Oregon,.

Kozma, R.B., 2005. National policies that connect ICT-Based education reform to economic and social development. Hum. Technol., 1: 117-156.

McGorry, S.Y., 2002. Online, but on target? Internet-based MBA courses: A case study. Internet Higher Educ., 5: 167-175.

Moersch, C., 1995. Levels of technology implementation (LoTi): A framework for measuring classroom technology use. Learn. Leading Technol., 23: 40-40.

OECD., 2008. Trends shaping education. OECD, Paris.

Plomp, T., W.J. Pelgrum and N. Law, 2007. Sites 2006-International comparative survey of pedagogical practices and ICT in education. Educ. Inf. Technol., 12: 83-92.

Rassool, N., 1999. Literacy for Sustainable Development in the Age of Information. Vol. 14, Multilingual Matters Ltd, Clevedon, England, ISBN:1-85359-433-4, Pages: 265.

Rijal, S., 2016. The influence of transformational leadership and organizational culture on learning organization: A comparative analysis of the it sector. J. Administrative Bus. Stud., 2: 121-129.

Smeets, E., T. Mooij, H. Bamps, A. Bartolom and J. Lowyck *et al*., 1999. The impact of information and communication technology on the teacher. Institut e for Applie d Social Sciences Netherlands.

Supratman, L.P., 2015. A case study of classroom seating arrangement to promote students communication and interactivity in Telkom University. Intl. J. Humanities Arts Soc. Sci., 1: 130-133.

Weng, H.Y. and C.H. Yang, 2016. Culture conservation and regeneration of traditional industries derived by tourism factory-Case study of Kwong xi paper factory in Taiwan. Intl. J. Humanities Arts Soc. Sci., 2: 172-180.

Young, J., 2002. The 24-hour professor. Chronicle Higher Educ., 48: 31-33.

Yusuf, M.O., 2005. Information and communication technology and education: Analysing the Nigerian national policy for information technology. Intl. Educ. J., 6: 316-321.