



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

ICT in Education

Secondary Technical Vocational Education and Training Institute Centered Diffusion of Innovation in Rural Bangladesh

Khalid, Md. Saifuddin

Published in:

Proceedings of the 5th International Technology, Education and Development Conference

Publication date:

2011

Document Version

Accepted author manuscript, peer reviewed version

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Khalid, M. S. (2011). ICT in Education: Secondary Technical Vocational Education and Training Institute Centered Diffusion of Innovation in Rural Bangladesh. In *Proceedings of the 5th International Technology, Education and Development Conference* (pp. 1126-1134). Valencia: International Association of Technology, Education and Development (IATED).

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- ? Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- ? You may not further distribute the material or use it for any profit-making activity or commercial gain
- ? You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

ICT IN EDUCATION: SECONDARY TECHNICAL VOCATIONAL EDUCATION AND TRAINING INSTITUTE CENTERED DIFFUSION OF INNOVATION IN RURAL BANGLADESH

Md. Saifuddin Khalid

*eLearning Lab, Department of Communication and Psychology, Aalborg University,
Denmark,*

Email: khalid@hum.aau.dk

Abstract

Bangladesh, a developing and third world country, recognized for its microcredit success, has a favourable political environment to achieve 'Digital Bangladesh' by 2021. Government projects, public-private partnership projects, corporate social responsibility (CSR) activities and private initiatives for Information Communication Technology (ICT) for education are integrating telecenter models in secondary educational institutes. The three-fold objectives of these development projects are computer literacy for teachers and students, telecenter for community and access to better learning content or better learning. Little or no significant study had been conducted on the qualitative achievements of such projects traceable from early 2002. A secondary technical vocational education and training (TVET) institute of about 450 students in a village of about 5500 inhabitants is selected for a qualitative study using theories and methodologies adapted from different disciplines. This paper presents the plan for this action research to be conducted during August 2011 to December 2012 as part of the research project during September 2010 to June 2013.

As proponent of ICT for development, the author considers the problems of rural inhabitants (78%) living on agrarian livelihood, electricity insufficiency (47% from nation grid), socio-economic class gap and bias, lower education vs. employment association (as education for sustainability) and low access to ICTs. These might resist the intended objective of ICT for development projects. With decrease of technology obsolescence period if the technology 'domestication' is not proportionately increased, the digital divide will intensify. Bridging the digital divide (in terms of 'adaption') will become far reaching. Thus, firstly, this paper reviews different theoretical dimensions to converge towards a qualitative 'diffusion study' focusing socio-economic context. Secondly, the problems faced in implementing ICT in secondary institutions and telecenters of disadvantaged communities are reported to construct the problem boundary. Finally, the author proposes an intensive study using three different approaches to identify a preferable methodology for higher 'diffusion' or 'domestication'. Participatory Rural Assessment (PRA) will be used for identifying the achievement. Three different methodologies for diffusion include, firstly, smart class rooms and after-class telecenter model as part of a national pilot project; secondly, ICTs in co-curricular activities including self-learning and community teaching, ICT based academic administration; and thirdly, life and livelihood centred programs as part of telecentre.

In Bangladesh context, TVET institutes' students come from lower middle class or below. The motivation for these students is early employment or entrepreneurship with low capital investment. Unfortunately, TVET institutes seem to be victim of invisible bias in ICT expansion projects. Bangladesh Millennium Development Goal (MDG) progress report of 2009 shows downward index for employment. IT supports services personnel are mostly from TVET institutes. The study is expected to positively contribute and give a direction to achieve the goal using school-based telecentres.

Keywords: diffusion of innovations, participatory action research, ICT in education, telecenter, domestication, digital Bangladesh, smart classroom

1. INTRODUCTION

Information Communication Technologies (ICT) in Education is a multidisciplinary field which has inherent prospects and problems similar to any other innovation [1], [2]. Ample evidences demonstrated ICT application benefits in educating disadvantaged communities in the third world countries especially in Africa and Asia [3]. However, information ecologists claim that the effective and efficient use of technologies is deeply rooted to "why" people choose to use a technology, the local needs, values and norms [4]. Information architects suggest organizing information content using

appropriate media suitable for the users' use context and return on investment [5]. Present telecentre models of Bangladesh[6], can be integrated with these theories.

The Peoples Republic of Bangladesh, a developing country of South East Asia, is taking nation-wide initiatives towards an envisioned "Digital Bangladesh"[7]. The population of Bangladesh is about 149.5 million [8], about 76.90% living in rural area [9], about 16 million students in 82218 primary educational institutes [10], about 6.8 million in 18756 secondary institutes among which 15785 institutes are in rural areas[11]. Digital Bangladesh initiatives are thus mostly rural focused and education centered. Government, private, corporate, public private partnership, donor projects, institute level changes and individual efforts are going in parallel to include Information Communication Technologies (ICTs) for effective utilization of "Digital Bangladesh" movement [7], [12], [13]. However, socio-economic condition of the large rural & agrarian country gets only 47% power supply from national grid with per capita consumption of 156 Kwh [14], among 11 years and above 34.2% are non-literate[15], lack of physical access to ICTs, social class gaps and bias, family resistance etc. are barriers of such initiatives. Recent ICT in education projects in developing countries attempt to achieve ICT adoption, better education, and access to information by using school-based telecentre model [16] [17][18]. Theory of diffusion of innovations [19] and theory of domestication of media and technology [20] provide ways to address some of above barriers.

In Bangladesh, the Technical Vocational Education and Training (TVET) institutes were established to create employment opportunities and entrepreneurship ability for the youth [21]. These institutes are attractive only for the lower middle and lower economic classes. For socio-economic background of family and academic environment, ICT skill level often remained low in any education stem. In this context TVET might prove sustainable for ensuring job or livelihood [22] due to higher subject association with ICT. Therefore, theories on "education for sustainability" [23], specifically livelihood or employment, for disadvantaged communities are considered in selecting a TVET institute for this project.

In the absence of significant qualitative outcome analysis of ICT usage by students and surrounding community as a contribution of various development projects, this study attempts to deploy and compare three alternative approaches to diffuse ICT in the school and the village it is situated in. This study will also identify contribution in millennium development goal targets, namely employment to population ration (target 1B), internet and cellular subscriber per 100 population (target 8F) [24]. This paper presents the initial plan for this action research to be conducted during August 2011 to December 2012 as part of the research project during September 2010 to June 2013.

2. RESEARCH OVERVIEW

2.1. Background of the Study

In October 2010, Bangladesh government, Bangladeshi NGO DNet and Volunteers Association of Bangladesh (VAB) initiated a three-year public-private initiative to establish 100 Smart Class Rooms (SCR) as Computer Literacy Center (CLCs), in 100 secondary schools of rural areas[25]. The project aims at ensuring participation from local community for financial initiatives; teacher training; design, develop and adapt English, Science and Geometry teaching-learning using DNet created content; provide access to community people after the school hour. The expected outcome is ICT education for 15000 students, ICT based learning for 35000 students, teacher training for 600 teachers and above all access for community. During 2004 to December 2009 with support from VAB for Computer Literacy Program (CLP)[26] DNet had established and trained through 109 CLCs in 39 districts in Bangladesh[27]. There is significant number of different telecentre models including school-based telecentre models in Bangladesh. Apart from frequently available outcome analyses using descriptive statistics and success reflecting case stories, there is little or no evidence of qualitative study on the challenges and contributions of these telecentres. This action research along with a qualitative study is expected to contribute both the theory and practice of school-based telecentre models.

The author believes that Technical vocational institutes should have been considered as priority target group for these projects. Furthermore, alternative approaches to ICT inclusion in Education should have been explored. With the decrease in technology obsolescence period technology adoption and utilization should increase. A rural Bangladesh context specific effective ICT diffusion process around school based telecentre has not being identified, which this research attempts to explore.

2.2. Significance of the Research

ICT literacy is becoming pre-requisite to enabling citizens with quality information access and enabling students with education for sustainability. ICT development being very fast, literacy and adoption training is required to be proportionate. Socio-economic and socio-cultural condition might not embrace ICT for education. The Information ecology and information architecture in a social system are dynamic and continuously changing. Co-curricular activity oriented and community participated requirements focused ICT selection and training might have greater impact, which are required to be explored. Similar to failure of enterprise resource planning (ERP) software deployments, if national level initiatives fail to include target group participation, loss could be disastrous [28]. This research is expected to contribute to this national level issue.

Employment or livelihood increase is one of the millennium development goals (MDG) of Bangladesh, where the country is lagging behind [29]. Devised school-based telecentre model is expected to increase sustainability of education and also by contributing to employment or livelihood increase.

2.3. Review of Literature

An extensive literature review will be conducted on the following interconnected theoretical areas or keywords for elaboration of methodology and research plan. Some of the related papers are shown in Tab. 1.

Table 1. Theoretical dimensions of the research for review of literature

Keywords/Terms	References
Diffusion of Innovation	[19], [30], [3], [31]
Domestication	[20], [32]
Information Ecology, Cultural Ecology	[4], [33], [34]
Information Architecture	[5]
Ecopedagogy	[35], [36]
Information and Communication Technologies (ICTs)	[37], [38], [39]
ICT in Secondary Education	[40]
Technical Vocational Education and Training (TVET)	[22], [21]
Education for sustainability (livelihood or employment)	[41],[42], [23], [43]
Participatory Action Research (PAR)	[44]
Participatory Rural Appraisal (PRA)	[45]
Telecentre	[6], [38]
ICT-based Curricular, co-curricular and extra-curricular activities in School	[46], [47],[48], [49], [50]
e-readiness or e-preparedness	[28]
Digital divide	[47], [51], [52]

Diffusion of innovation being the core objective of this action research, terminologies associated with ICT and disadvantaged rural community will also be elaborated. As [53] summarizes [54] as “basic model of innovation” by “Firstly, any new form of behaviour must yield benefits that outweigh the costs or disadvantages (= “readiness” or R). Secondly, the new form must be legitimised, i.e., it must be culturally (ethically, morally) acceptable (= “willingness” or W). Thirdly, there must be adequate means, though not necessarily of a technical nature, to implement the new form (= “ability” or A). Moreover, the three preconditions must be met jointly for the new behavioural form to succeed. Hence, a success S can be expressed as $S = R \cap W \cap A$. This expression furthermore defines a bottleneck model, since the failure of satisfying one condition prevents the innovation from breaking through, even if the other two preconditions are met.” The study would attempt to qualitatively identify which of these three variables could be facilitated by the adopted telecentre model.

2.4. Research Problems

Due to various barriers the challenge is, “How much of ICT can be put into practice using school-based telecentres?” This question is further divided into following from the viewpoint of disadvantaged rural communities of Bangladesh (Fig. 1).

- Which information communication technologies (ICT) get diffused and why?
- What are the e-readiness, willingness and readiness requirements and how those can be satisfied?
- How curriculum and pedagogical adaptations are occurring?
- How co-curricular or extra-curricular activities can be used for ICT diffusion?

- How ICT in academic administration can be made acceptable to all?
- Does ICT in TVET directly contribute to employment or livelihood?
- Does the telecentre model improve local information support system or information ecology?

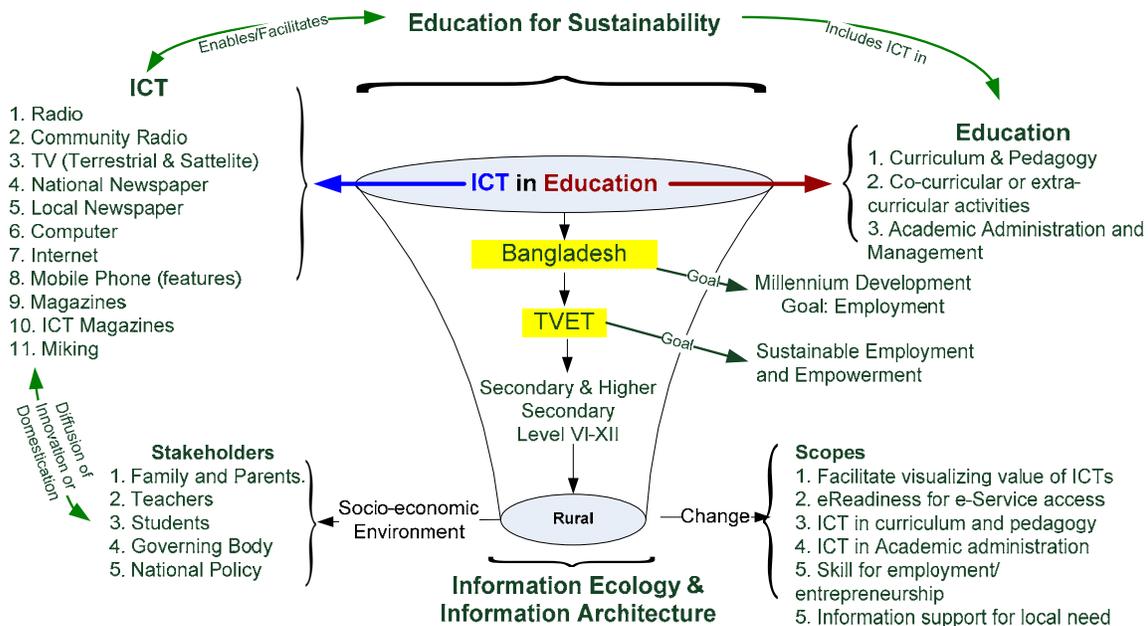


Fig. 1. Relationship among theoretical dimensions, project goals and scope

2.5. General Objectives

The general objectives of this “ICT in Education” research on “disadvantaged communities” is

- 1) to qualitatively compare three ‘diffusion communication’ [19] strategies using diffusion of innovation theory focusing ICTs in a vocational school
- 2) to develop a specific methodology of Participatory Rural Appraisal around the school
- 3) to conduct Participatory Action Research for integrating ICT training for Education for sustainability (livelihood/employment)
- 4) to develop a diffusion communication through co-curricular/extra-curricular activities
- 5) to identify factors affecting integration of ICT in curricular activities and academic administration
- 6) to qualitatively study the response of teachers, students, parents and rural community towards technology integration in school
- 7) to study the information ecology in current rural setting

2.6. Limitations of the study

Unpredictability associated with time and cost issues of participatory action research are core limitations.

3. PROPOSED RESEARCH METHODOLOGY

3.1. Baseline Study: Participatory Rural Appraisal

A participatory rural appraisal (PRA) will be conducted following the present practice by Bangladesh Academy for Rural Development (BARD)[55] and Rural Development Academy (RDA) [56] . Questionnaires will be developed to suit the context shown in table 3. Senior students of the TVET institute will be grouped in team of five according to their residence in *para* (zones of village) and conduct PRA in their own *para*. PRA experienced students from a private university in Bangladesh will work with each team. The study typically takes 10 working days including 2 working days of training. The outcome would be a baseline study on existing ICT environment in the village.

3.2. Diffusion Communication

3.2.1. ICT in Curricular Activities and After-school Telecentre

A Computer Literacy Center (CLC) will be developed along with Smart Class Room (SCR) under Computer Literacy Program (CLP) [26] under the pilot program for ICTs in Education under Public

Private Initiative[25]. In a SCR, students will learn through the use of interactive educational CDs and the Internet. The CDs prepared by experts will allow quality classroom education for the students, and at the same time, become useful tools for training local teachers in better teaching methods.

3.2.2. ICT in Co-curricular or extra-curricular activities and academic administration

The Duke of Edinburgh's (DofE) Award International Association [57] coordinates the community based service award program as part of co-curricular activities of schools to universities in Bangladesh since 2009 [58]. Two teachers will receive award leader training from the DEA trust in Bangladesh. Students enrolled will have to spend at least 6 months and spend certain amount of time to fulfil the four criteria, which are service, adventurous journey, skills and physical recreation. Under 'skills' category, students will be provided with Student's manual, "Esho Computer Shikhi" (Let's Learn Computer) and Computer Teaches Everyday English (CTEE) of DNet. Under 'Service' category, students will teach their family member(s) the same ICT skills to do self learning using computer. Some students may take some hours to do gain 'skill' and provide 'service' at the telecentre. Some students will be given skills training for providing free troubleshooting and support services to people. For the 'adventurous journey' students will take a trip to the capital to visit largest computer market and mobile phone market. On return 'an essay writing' competition will be held select the best article on 'a day with technology' where an imaginary story of using various ICT devices and features will be described as part of a regular day. DofE activities are supposed to be free to students to choose. However, due to resource constraints if students are facilitated with new opportunities, students enjoy and participate spontaneously.

Community Radio Operation by School for Society (CROSS) is a program of BNNRC [59] which will be part of the DofE activity for a test basis, according to the given regulation of Bangladesh.

All teachers will be given in-house training to use basic office applications for records keeping. For accessing board results through internet training will be provided on basic internet browsing. Searching university admission information for their students, websites for searching job scopes, writing CV, writing a testimonial and writing Bangla using phonetic keyboard etc. will be introduced to teachers. Official record keeping will be enforced.

3.2.3. ICT for life and livelihood

Following programs will be initiated in the village

- A. Pallitathya (rural information) Help Line [59] which provides villages a set of mobile phone numbers to make a specific query on any livelihood matters or to send some urgent information associated with the program. Access to CD based content and pallitathya.org website browsing will be also facilitated through the telecentre.
- B. Infolady: The "Infolady", is a new concept evolved from the experience of 'Mobile Lady', coined and operated by DNet [60]. The mobile lady is equipped with a netbook (e.g., CMPC or EEE PC) is loaded with offline Bangla livelihood content and audio-visual content, internet modem, headphone, webcam, digital camera, mobile phone and some other light equipments like weight measurement machine, blood pressure machine, pregnancy test kit, sugar test kit etc. Women have been chosen for the infolady initiatives since they have a better access to the conservative households as well as for the handicapped and illiterate. Pallitathya help line is part of the role of infolady.
- C. "Abolombon: Empowering People through Improved Access to Livelihood Information, Governance and Human Rights"[61]. Information support will be provided through CD version of the website abolombon.org accessible through the telecentre.
- D. Computer Teaches Everyday English (CTEE) will be available for all village residents and students during the after school hours at the telecentre.
- E. Access to information for Improvement of Rural Livelihood [62]
- F. Female teachers and students will be provided a handbook written in Bangla, titled "Technology and Women", to give realization on the role of domestic stakeholders, technology for empowering women and technology for reducing poverty [63].

3.3. Follow-up Study: Participatory Rural Appraisal

A follow-up study will be conducted after one year of initiating the action research. A PRA study will be repeated. An extensive qualitative study will be conducted throughout the study duration. Case stories will be reported as part of the qualitative study. Methodology of qualitative study plan is in progress at the time of writing this paper.

Table 3. Participatory Rural Assessment (PRA): Addressing ICT context

Factors influencing use of ICTs	Access to Technology	Human Capacity	Enabling Environment
Social Classes/families	<ul style="list-style-type: none"> Physical access Appropriateness of technology Affordability and use 	<ul style="list-style-type: none"> Human capacity and training Locally relevant content, application and services Integration into daily routine Social appropriation 	<ul style="list-style-type: none"> Socio-cultural factors Local and micro-economic environment Political will & public support Legal & regulatory framework
Academic Institution			
Personal			
Other Sources			

4. RESEARCH LOCATION AND RESOURCE ALLOCATION

A secondary technical vocational education and training (TVET) institute of about 450 students in a village of about 5500 inhabitants is selected for a qualitative study using theories and methodologies adapted from different disciplines. This action research will be conducted during August 2011 to December 2012 as part of the research project during September 2010 to June 2013. The follow-up study will be conducted in December 2012.

The research will be supported by Bangladesh NGOs Network for Radio and Communication (BNNRC)[64] and Development Research Network (DNet)[65].

5. EXPECTED OUTCOMES OF THE PROJECT

- Adopted school-based telecentre model for rural secondary educational institutes
- Qualitative analyses and understanding on three different diffusion communication strategies.
- An ICT diffusion process through co-curricular activities for academic institutions
- A school-based participatory rural assessment (PRA) methodology adoption for local information repository creation
- Understanding on TVET school-based telecentre model's contribution to livelihood or employment

REFERENCES

- [1] Tjeerd Plomp, Ronald E. Anderson, Nancy Law, and Andreas Quale, *Cross-National Information and Communication Technology Policy and Practices in Education*. USA: Information Age Publishing Inc., 2003.
- [2] Sarah Lucas Paezevara and Rubina Khan. (2007, December) Asian Development Bank. [Online]. <http://www.adb.org/Documents/Reports/Consultant/39035-REG/appendix11.pdf>
- [3] Katherine Morrow, "Information villages: Connecting rural communities in India," *Leisa Magazine*, pp. 28-30, July 2002.
- [4] Bonnie A. Nardi and Vicki L. O'Day, *Information Ecologies: Using information with Heart*. Cambridge: Massachusetts Institute of Technology, 1999.
- [5] Peter Morville and Louis Rosenfeld, *Information Architecture for the World Wide Web*. Cambridge: O'Reilly Media Inc., 2007.
- [6] Md. Shariful Islam and Md. Nazmul Hasan, "Multipurpose Community Telecentres in Bangladesh: Problems and Prospects," *The Electronic Library*, vol. 27, no. 3, pp. 537-553, 2009.
- [7] (2010, November) Official Website of Digital Bangladesh. [Online]. <http://www.digitalbangladesh.gov.bd/content.php?CID=2>

- [8] (2010, November) Bangladesh Bureau of Statistics. [Online]. <http://www.bbs.gov.bd/Home.aspx>
- [9] (2008, February) Bangladesh Bureau of Statistics. [Online]. http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/Test1/SAARC_Part-1.pdf
- [10] BANBEIS. (2008) Bangladesh Bureau of Educational Information and Statistics (BANBEIS). [Online]. http://www.banbeis.gov.bd/db_bb/primary_education_1.html
- [11] BANBEIS. (2008) Bangladesh Bureau of Educational Information and Statistics. [Online]. http://www.banbeis.gov.bd/db_bb/secondary_education_1.htm
- [12] Ananya Raihan and Shah M. Ahsan Habib. (2008) The International Development Research Centre. [Online]. http://www.idrc.ca/en/ev-127071-201-1-DO_TOPIC.html
- [13] (2009) Bangladesh Telecentre Network. [Online]. http://www.mission2011.net.bd/index.php?view=category&id=67:btn-media-coverage&option=com_content&Itemid=102&lang=bn
- [14] (2009) Bangladesh Power Development Board. [Online]. <http://www.bpdb.gov.bd/distribution.htm>
- [15] BBS and UNESCO, "Literacy Assessment Survey 2008," Dhaka, 984-508-625-X, 2008.
- [16] Nagy K. Hanna, "Shared Access for Inclusive Society," in *E-TRANSFORMATION: ENABLING NEW DEVELOPMENT STRATEGIES*.: Springer Science+Business Media LLC., 2010, pp. 235-248.
- [17] Cheryl Ruth R. Soriano, "Exploring the ICT and Rural Poverty Reduction Link: Community Telecenters and Rural Livelihoods in Wu'an, China," *The Electronic Journal of Information Systems in Developing Countries*, vol. 32, 2007.
- [18] Wallace Chigona, "Should communal computing facilities cohabit with public facilities?," *Journal of Community Informatics*, 2006.
- [19] Everett M. Rogers, *Diffusion of Innovations*. New York: The Free Press, 1995.
- [20] Thomas Berker, Maren Hartmann, Yves Punie, and Keti J. Ward, *Domestication of Media and Technology*. New York: The Free Press, 2006.
- [21] Phuntsho Wangmo, Mohammad Asif, and Mostafizur Rahman, "TVET: a path way to alleviation of poverty in the sub region countries," in *International Symposium on Skills Development for Poverty Alleviation: 2008, Manila, Manila, 2009*, pp. 71-85.
- [22] Chiranjib Kumar Basu and Shyamal Majumdar, "The Role of ICTs and TVET in Rural Development and Poverty Alleviation," in *International Handbook of Education for the Changing World of Work*.: Springer Science+Business Media, 2009, pp. 1923-1934.
- [23] John Huckle and Stephen Sterling, *Education for Sustainability*. London: Earthscan Publication Limited, 1996.
- [24] (2010, November) Bangladesh Bureau of Statistics. [Online]. <http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/Latest%20Statistics%20Release/Mill>

[enium_Development_Goals.pdf](#)

- [25] DNet. (2010, October) DNet- Development Research Network. [Online]. <http://www.dnet-bangladesh.org/RnPHNewsDetails.php?Id=50&&NewsType=2>
- [26] Computer Literacy Program. (2009) Computer Literacy Program. [Online]. <http://www.clp.net.bd/>
- [27] (2009) DNet - Development Research Network. [Online]. <http://dnet.org.bd/CommonPageDetails.php?MenuId=159&ColCls=blueHead>
- [28] Glenn Stewart, Michael Milford, Tony Jewels, Therese Hunter, and Brian Hunter, "Organisational Readiness for ERP Implementation," in *AMCIS 2000 Proceedings*, Brisbane, Queensland, Australia, 2000, pp. 966-971.
- [29] Planning Commission of Bangladesh, "The Millenium Development Goals - Bangladesh Progress Report," Dhaka, 2009.
- [30] Wei-Mann Lee and Yung-Sheng Chang, "A SWOT Analysis of m-Learning Diffusion in China and Taiwan," in *Fifth IEEE International Conference on Wireless, Mobile, and Ubiquitous Technology in Education, 2008. WMUTE 2008.*, Beijing, 2008, pp. 219 - 221.
- [31] Sang Hui-An and Tsai Dwen-Ren, "Analyzing Strategies of Integrating ICT into Teaching Activities Using Innovation Diffusion Theory," in *Fifth Internation Joint Conference on INC, IMS and IDC*, 2009, pp. 1876-1878.
- [32] Agnes Chigona, Wallace Chigona, Patrick Kayongo, and Moses Kausa, "An emperical survey on domesticatin of ICT in schools in disadvantaged communities in South Africa," *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, vol. 6, no. 2, 2010.
- [33] Niki Davis, Christina Preston, and Ismail Sahin, "Training Teachers to use new technologies impacts multiple ecologies: Evidence from a national initiative," *British Journal of Educational Technology*, vol. 40, no. 5, pp. 861-878, 2009.
- [34] Mikko Vesisenaho and Patrick Dillon, "Information and Communication Technology Education Centextualized in a Cultural Ecological View of Learning," in *39th ASEE/IEEE Frontiers in Education Conference*, San Antonio, TX, 2009.
- [35] Richard Vernon Kahn, "The ecopedagogy movement: From global ecological crisis to cosmological, technological, and organizational transformation in education," University of California, Los Angeles, Los Angeles, Dissertation ISBN: 9780549482529, AAT 3302520, 2007.
- [36] Richard Kahn, *Critical Pedagogy, Ecoliteracy & Planetary Crisis: The Ecopedagogy Movement*. New York: Peter Lang Publishing, Inc., 2010.
- [37] Faheem Hussain and Rahul Tongia, "Cross technology comparison for information services in rural Bangladesh," in *2009 International Conference on Information and Communication Technologies and Development (ICTD)*, Doha, 2009, pp. 252 - 266.
- [38] Christopher Coward, Ricardo Gomez, and Rucha Ambikar, "An Assessment of Venues Providing Public Access to ICT: A Tale of 25 Countries," in *Proceeding of the 42ndn Hawaii International Conference on System Sciences*, Big Island, HI, 2009, pp. 1 - 9.

- [39] Carol Upadhya, "ICTs and Indian Social Change: Diffusion, Poverty, and Governance," *Pacific Affairs*, vol. 83, no. 2, pp. 406-407, 2010.
- [40] Felicity Binns and Tony Wrightson, *Teacher Education at a Distance: Impact on Development in the Community*, 2006.
- [41] Paul Clarke, "Sustainability and improvement: a problem 'of' education and 'for' education," *Improving Schools*, vol. 12, no. 1, pp. 11-17, 2009.
- [42] Moacir Gadotti, "Reorienting Educational Practices towards Sustainability," *Journal of Education for Sustainable Development*, vol. 4, no. 2, pp. 203-211, 2010.
- [43] Astrid von Kotze, "Negotiating TVET for sustainable livelihoods," *Journal of Workplace Learning*, vol. 20, no. 7/8, pp. 480 - 491, 2008.
- [44] M.K. Joseph and T.N. Andrew, "Participatory approaches for the development and use of Information and Communication Technologies (ICTS) for rural farmers," in *IEEE International Symposium on Technology and Society (ISTAS)*, Fredericton, NB, 2008, pp. 1 - 13.
- [45] Global Communication Center & Kyushu University. (2010, August) GramWeb. [Online]. http://gramweb.net/m_news_dtls.php?id=42
- [46] Julius Njanji, Ronald Kwemain, and Calisus Taku, "Closing the digital gap in Camroonian secondary schools through the CIAC project," *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, vol. 6, no. 2, 2010.
- [47] G.B. Gudmundsdottir, "From digital divide to digital equity: Learners' ICT competence in four primary schools in Cape Town, South Africa," *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, vol. 6, no. 2, 2010.
- [48] Julie Cogill and Alan Parr, "Football - A motivation for mathematics?," *Mathematics Teaching*, pp. 40-42, 2006.
- [49] Jonathan F. Smith, "Digital Natives: Student ICT Use and Educational Participation in Queensland Secondary Schools," Brisbane, 2007.
- [50] Kimiko Fujita. (2006) Undergraduate Research Journal for the Human Sciences. [Online]. <http://kon.org/urc/v5/fujita.html>
- [51] Karine Barzilai-Nahon, "Gaps and Bits: Conceptualizing Measurements for Digital Divides," *The Information Society*, vol. 22, no. 5, pp. 269-278, 2006.
- [52] Vasja Vehovar, Pavle Sicherl, Tobias Husing, and Vesna Dolnicar, "Methodological Challenges of Digital Divide Measurements," *The Information Society*, vol. 22, no. 5, pp. 279-290, 2006.
- [53] R. Lesthaeghe and K. Neels, "From the First to the Second Demographic Transition: An Interpretation of the Spatial Continuity of Demographic Innovation in France, Belgium and Switzerland," *European Journal of Population/Revue europeenne de Demographie*, vol. 18, no. 4, pp. 325-360, 2002.
- [54] Ron Lesthaeghe and Camille Vanderhoeft, *Ready, willing and able: a conceptualization of transitions to new behavioural forms*, J.B. Casterline, Ed. Washington, DC: National Academy

Press, 2001.

- [55] BARD. (2010) Official Website of BARD. [Online]. <http://www.bard.gov.bd/>
- [56] RDA. (2010) Official Website of Rural Development Academy of Bangladesh. [Online]. <http://www.rda.gov.bd/>
- [57] (2007) The Duke of Edinburgh's Award International Association. [Online]. <http://www.intaward.org/>
- [58] "Formal launch of Duke of Edinburgh's Award," *Star Campus*, vol. 2, no. 1, p. 13, April 2009, URL: http://www.thedailystar.net/campus/2009/04/01/feature_award.htm.
- [59] Pallitathya. [Online]. <http://www.pallitathya.org/MainDetails.php?id=44>
- [60] Md. Hasan. (2009, Aug.) The Daily Star. [Online]. <http://www.thedailystar.net/newDesign/news-details.php?nid=99804>
- [61] Pallitathya. [Online]. <http://www.pallitathya.org/MainDetails.php?id=49>
- [62] Pallitathya. [Online]. <http://www.pallitathya.org/MainDetails.php?id=45>
- [63] Ananya Raihan, Mahmud Hasan, and Afrina Tanzim. Official Website of DNet. [Online]. <http://www.dnet-bangladesh.org/KPBookDetails.php?BookType=10&&id=43>
- [64] (2011) Bangladesh NGOs Network for Radio and Communication. [Online]. <http://www.bnnrc.net/>
- [65] DNet. (2004) Official Website of DNet. [Online]. <http://www.dnet-bangladesh.org>
- [66] Pallitathya. [Online]. <http://www.pallitathya.org/MainDetails.php?id=48>