Informatics Education in Turkey: National ICT Curriculum and Teacher Training at Elementary Level

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Abstract. This article is a summary of the work carried out by the Ministry of Education in Turkey, in terms of the development of a new ICT Curriculum, together with the e-Training of teachers who will play an important role in the forthcoming pilot study. Based on recent literature on the topic, the article starts by introducing the "F@tih Project", a national project that aims to effectively integrate technology into schools. After assessing teachers' and students' ICT competencies, as defined internationally, the review continues with the proposed model for the e-training of teachers. Summarizing the process of development of the new ICT curriculum, researchers underline key points of the curriculum such as dimensions, levels and competencies. Then teachers' e-training approaches, together with selected tools, are explained in line with the importance and stages of action research that will be used throughout the pilot implementation of the curriculum and e-training process.

Keywords: informatics education, ICT curriculum, teacher training

1 Introduction

The term of "informatics", inferred from "information" and "automatics" has its origin in Europe, but it is not in common use in other countries of the world. ICT is the mutual term in most European countries; in Austria it is called "informatics" [23]. If ICT is one side of the medal, informatics is the other side. As discussed at the ISSEP conference in March 2005 in Klagenfurt (http://issep.uni-klu.ac.at), the topic of "Does ICT eat or feed informatics" did not lead to a clear conclusion. As [23] stated, the borderlines cannot be drawn exactly, but they are fairly indistinct and floating. In our country the term ICT Education is perceived as Informatics Education, which aims to develop students' computer literacy, technology awareness, computer usage and problem solving skills.

National development depends on investment in human resources, and a nation's future correlates with the education system training these resources. The F@tih Project[4] is

[4] F@tih Project: http://fatihprojesi.meb.gov.tr

a transformation movement at a national level, having various and important outcomes, particularly the ICT curriculum and teachers training in ICT competencies. These are the two burning topics in terms of the project's success, as defined at a recent project evaluation workshop. Existing curricula, e-content and teaching approaches are inadequate in terms of what the project aims to achieve. What is more, not only for the F@tih project, but also to help Turkey strive towards reaching the goal of an information society, the ICT curriculum should be redesigned. In the information society, each student should be provided with the opportunity of taking advantage of technology [3]. ICT will be used as a tool for learning and for shaping the future of each student if the students are provided with the appropriate technologies and approaches at the right age.

2 Literature Review

2.1 About the F@tih Project and EBA

In the F@tih project, ICT tools and resources will be used to address inadequacies in the learning and teaching processes for 620,000 primary and secondary-education students. The aim is to increase learning and teaching opportunities and to enhance the schools by using ICT tools and resources. For all classrooms LCD interactive smart boards and tablet PCs will be provided as well as a purpose-designed network infrastructure. In-service training will be provided for teachers to enable them to use and adapt ICT tools and resources efficiently within their teaching and learning processes. The five main components of the project are:

1. Providing hardware and software infrastructure
2. Providing and managing educational e-content
3. Ensuring the effective use of ICT in the curriculum
4. In-service teacher training
5. Deliberative, safe, manageable and measurable use of ICT

The project is being carried out by the Ministry of National Education, supported by the Ministry of Transport, and is planned to be completed in 5 years.

For supporting the project, a web portal named EBA (Eğitim Bilişim Ağı (tr) – Education and ICT Network) is designed in order to address both teachers' and students' needs. In EBA, which is in test use now, there are eight main services, namely: (1) News, (2) e-Content, (3) e-Book, (4) Video, (5) Audio, (6) Images, (7) Forum, and (8) Map. In the News section information about project process, new progresses and some announcements is provided. The e-Content section contains shared work of universities and schools. In the e-Book section sample interactive course books are provided. The Video section offers videos about course contents, documentaries, and interesting scientific topics. The Audio section does not only cover courses, but also social life, including poems and stories, in order to help students improve their competence. The Archive of the Ministry of Education provides a big variety of photographs on course components to students and teachers. In the Forum part students, teachers and other stakeholders of the project can ask each other questions and carry out discussions. In the Map section there is a world map. Students can use it to find a city, region or country they want to learn about. Although a great variety of electronic content is available to students and teachers, EBA is the main umbrella that provides trusted shared content.

2.2 ICT Competencies for Students and Teachers

With the continuous emergence of new technological developments and innovations in the 21st century, today's teachers need to be better prepared and consider new approaches in order to bring information and communication technology skills into their classrooms. According to the UNESCO ICT Competency Standards for Teachers, they should acquire the skills and standards to empower their students with the benefits technology offers, should teach the subject effectively integrating technology and support the personal development of students [33]. In addition, teachers should have a vision of integrating technology into teaching and learning, they should develop an understanding of and capability with ICT, understand how to detect and develop students' ICT capabilities, teach effectively using technology and manage learning environments safely [2].

Not only teachers, but also students should increase their ICT capabilities. In general, ICT competencies for students can be summarized under main headings as: creativity and innovation, communication and collaboration, research and information fluency, critical thinking, problem solving, decision making, digital citizenship, and technology operations and concepts respectively [35]. For information literacy learners should assess the information process and learn to use tools like online catalogues and keyword search strategies; in terms of communication and collaboration they should work on a collaborative project, use different media to collect information; for authoring, they should publish a piece of original work and comply with copyright conventions; for organizational tools they should use the features of a network and work with spread sheets and databases; finally for presentation and visual display, they should develop and deliver a presentation and a display [6].

2.3 Teacher Training

In order to enhance knowledge about digital technology in teacher training and to enable teachers to integrate information and communication technology into educational settings and to become conversant with the use of the Internet and ethical issues concerning the web, a collaborate approach is adopted and online education is preferred in most countries in the world [21]. Most of the training programs, as in Korea, are designed as self-directed and self-paced [19]. For more efficient training, smaller-scale training program sessions were held in smaller regions, as in 25 areas throughout Taiwan [5]. To support this online education via website, sometimes face-to-face meetings and conferences are held. In general, video conferencing, Web 2.0 tools, webinars and online discussions are the tools preferred most [28]. As [18] stated, online discussions help to build a community of practice and also reduce the sense of loneliness.

In teacher training projects across many countries teachers are able to send, upload and share files, photos, etc. with their colleagues. In order to motivate teachers and increase participation in training, some reinforcement techniques are used such as issuing certificates or offering training at graduate schools. Using the module of EBA, sharing and collaboration address the needs of teachers in terms of experience, good examples, administrative issues etc. The Distance Education Center (DEC), which is a part of EBA, has been established to reach teachers indifferent regions of Turkey. In order to

train teachers, three different perspectives of adult learning are being used according to teachers' needs and status. To keep teachers updated all the time, a live broadcast called "ICT Talks" is put into practice. In this broadcast different burning topics, such as internet and ethics, Web 2.0 tools and technology integration strategies are discussed briefly once a week. In addition to this, webinars about trends will be held in order to enhance teachers' knowledge about technology integration. Briefly, it became obvious that teachers are more interested and generally more active in these online training programs. On the other hand, problems are frequently encountered, such as technical issues, a lack of equipment or badly managed forum discussions. Periodically, feedback from the participants is collected, results are collated and evaluated and the training programs are adjusted accordingly [36].

3 National ICT Curriculum

The existing ICT curriculum, which is used to facilitate information and communication technologies in schools, is limited as to the technologies and software provided to learners. Today, however, we have unlimited choices and resources available for meeting our expectations. ICT should be used effectively and efficiently in order to overcome possible obstacles in teaching-learning processes and add value to societies' existing structures and cultures [27]. From a technological point of view learning in digital environments, augmented reality, mobile learning and social networks are visions of BECTA [3] as future dimensions in technology.

Hence, a new curriculum should consist of important concepts such as digital literacy, technology use, ethical considerations, security, privacy, programming concepts and cybercrimes from the perspective of both the individual and society. In other words, the main goal of the new curriculum is to build up a "new culture" about the use of technology rather than teach the usage of specific software based on a constructivist and cognitivist point of view with a learner-centered approach. Moreover, technology usage should be integrated into all other courses [9].

In order to meet the demands of the information age it was a necessity to create a new ICT curriculum. Defining ICT standards expected from learners, as knowledge, skills and values, is of great importance for defining teacher competencies and learners achievement levels [31]. Creating standards is an effective and important way of learning, since expectations are defined clearly [24, 29]. Hence, a standards-based curriculum approach was preferred and a framework was established based on the international standards of ICT [25, 26, 30], which was composed of four dimensions: (1) Digital literacy, (2) Communication, Knowledge Sharing and Self-Expression via ICT, (3) Research, Knowledge Construction and Collaboration and (4) Problem Solving, Programming and Development of Authentic Materials. The general goal of the standards-based curriculum was formulated as: "learners are expected to use information and communication technologies effectively, efficiently and in parallel with the ethical values". The official name of the course is specified as "Information and Communication Technologies and Software".

On the other hand, it is important to consider both cognitive and technical competencies in the curriculum development process. Digital literacy is achieved through

the use of digital technologies, communication tools and social networks in the process of accessing, managing, designing, evaluating and creating information by means of cognitive and technical knowledge, skills and values through hands-on experience [8]. Moreover, based on the fact that learners will have different prior knowledge on the topic, each learner should be provided with an individual instructional design according to her/his background knowledge.

Mainly three levels were formed with two dimensions in each level, based on some taxonomies and levels defined by various researchers as can be seen in Table 1 [14, 32, 34].

Table 1. ICT levels for learners used as a guide while specifying learning outcomes

Level	Explanation
Basic I	Understanding ICT
Basic II	Accessing and Evaluating information
Intermediate I	Managing information
Intermediate II	Transforming information
Advanced I	Creating information
Advanced II	Sharing information

While implementing the curriculum, teachers will find out the level of each learner and will try to improve it for each learner individually or for the group. During the implementation of the program, teachers are free to decide what they will teach and how. The key point for teachers here is to choose up-to-date topics and activities. The main goal is to create a culture about ethical usage of technology and to enhance the competence of each student. Students completing all the levels will be directed to bigger projects and competitions.

As for the teaching-learning process, measurement and evaluation within the course will also be learner-centered. Hence, alternative assessment approaches are preferred for evaluating the process and product from an authentic point of view. For providing teachers with the tool of evaluation, fulfilling the premise of learner-centeredness together with constructivist and cognitivist approaches, e-portfolio assessment is chosen as the evaluation method for this course [16]. This approach will not only enhance contributions to a national content development process by the use of national products like EBA, Kırk Ambar etc., but will also make learners learn by doing.

4 Training Teachers at a Distance: Expected Competencies and e-Learning Approach

Effective use of technology during the implementation of the F@tih Project and the implementation of the new ICT curriculum require teachers to learn and master different competencies. To this aim, teachers' ICT competencies were basically grouped

under headings as: skills and practice, knowledge and understanding, and values and attributes. To achieve these competencies teachers need training, and the only way to reach all the teachers in a short space of time is to use the Internet and web-based technologies, i.e. through e-learning. Keeping in mind the differences that exist in schools, in terms of technical infrastructure, prior knowledge, learner competencies and expectations, sustainable e-training of the teachers seems to be the best solution. Gaible and Burns [15] also recommended to give teachers enough training and support for an effective integration of the technology, to make them adopt applications in learning environments quickly and to ensure sustainability of the training process by considering three different approaches: (1) Content Delivery System (for gaining expertise and pedagogical knowledge), (2) Application (for creating opportunities to experience the technology) and (3) Diffusion of new innovations (disseminating successful samples and learner-centered teaching approaches). Hence, an open-source learning management system together with the products for sharing and communicating like Web 2.0 tools were used to form an "e-Training Portal" for teachers.

It is imperative to use information and communication technologies for teacher training in this information age when the advantages are considered. Applicable approaches in this teaching-learning process can be grouped as: (1) Individual learning, (2) e-Content and (3) Communities of practice [15]. Hence, any e-Training portal should at least be providing these three approaches for enriching the learning process and addressing possible individual differences.

Keeping all these facts in mind, an "e-Training Portal for Teachers" has been designed and developed (Fig. 1).

5 Collaboration and Research Model for Enhancing Quality

Action research is a collaborative activity among colleagues searching for solutions to real life problems experienced in schools, or seeking for ways to enhance instruction and increase student achievement [13]. The aim of action research is to enhance and improve the professional development and the application of the user in daily life environments [7]. In action research the process teacher can search for ways to improve students' learning or focus on his/her own method that he/she uses [17]. From this point of view action research is a special research method that lets teachers and other educators enhance and improve teaching practices [7]. Generally action research

1. helps teachers to recognize the problems about education issues and solve them,
2. may create web site based communities for practice and
3. helps to enhance and improve teacher capacity in terms of collaboration and support.

As [20] (1998) stated that action research is constructed by eight phases which are based on three main key questions. These phases can be seen in Fig. 2.

1. Define current situation (Phase 1, 2, 3,4)
2. Decide what to change and implement (Phase 5)
3. Search on effects of changes (Phase 6, 7, 8)

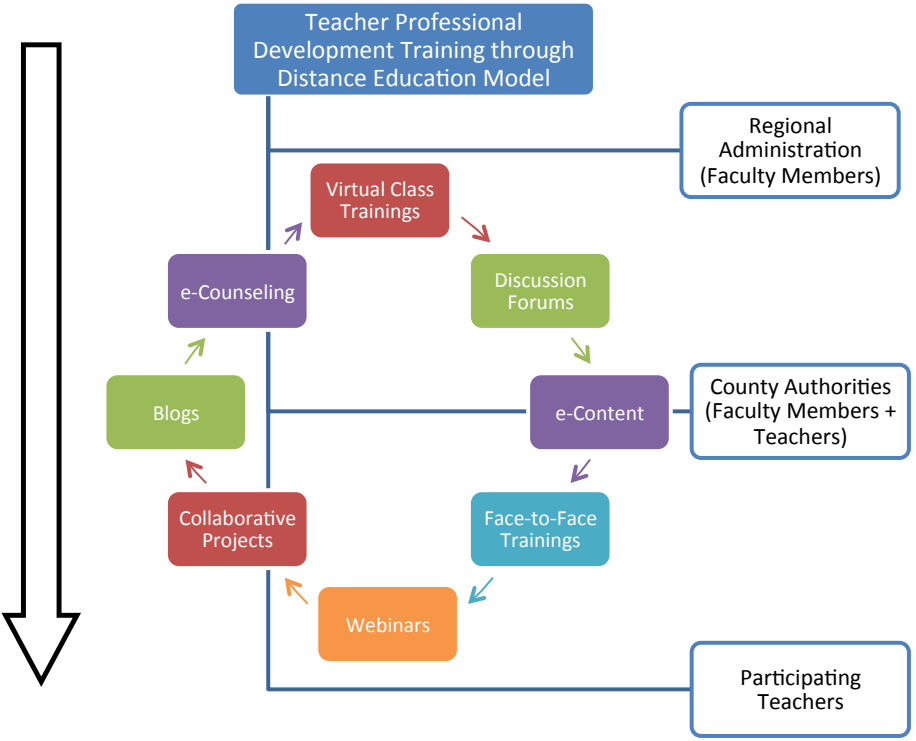

Fig. 1. Teacher Professional Development Training through Distance Education Model

In light of this information it is determined that action research is the most suitable method for a collaboration and research model. Within the scope of action research, the project is planned to be evaluated in terms of planning and coordination, in-service training, teachers' and students' issues in different phases of the project. Information and the thoughts of stakeholders, who are at different levels of the project, will be gathered by action research, which encompasses both qualitative and quantitative methods. The action research will be cyclical, repeated after each semester. After phase eight of an action research, according to the previous cycle's findings, it will be repeated in terms of project efficiency and success in the following semester.

5.1 Planning & Coordination

Activity reports, questionnaires about in-service training and teachers, interviews with project executives and managers are the basic instruments of collecting data. Comparing plans and outcomes of the project, identifying the possible mistakes and finding or suggesting solutions according to the situations are the fundamental aims of the planning and coordination phase in order to address project success and sustainability.

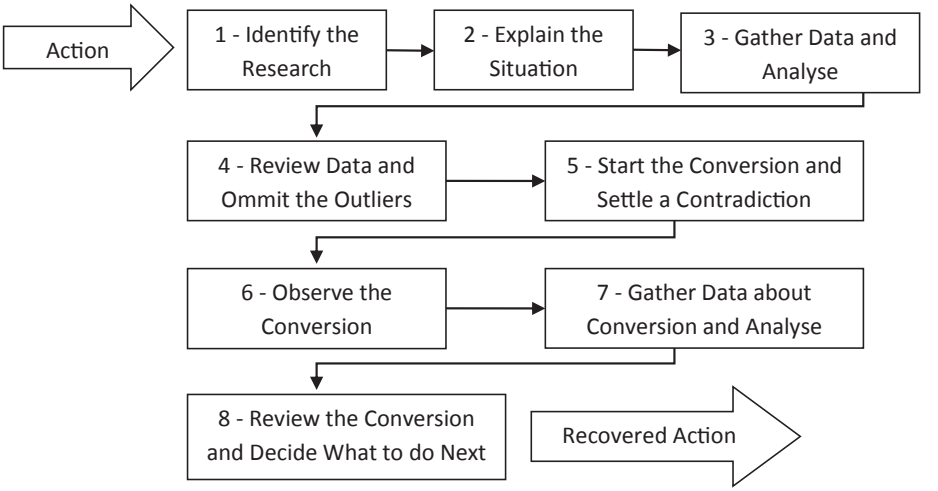

Fig. 2. Eight Phases of Action Research [20]

5.2 In-service Training

In-service training is one of the most important key points of the project. Plans, implementation and quality of the in-service training are the main issues of this phase in terms of the project's success. Thanks to technology integration, teachers are supposed to not only improve pedagogically, but also improve their high order skills in using ICT tools and sources. In order to accomplish this phase, teachers may be surveyed about their satisfaction and ICT usage and its integration into education. In addition, at the end of the semester, teachers' lesson plans could be analyzed in order to understand whether or not the information and skills from the in-service training have been put into action.

5.3 Teachers

Teachers, who are one of the largest stakeholders of the F@tih project, are in need of high order technology and pedagogical information such as how to implement ICT in education and how to address their students' needs. A survey could be conducted in order to evaluate teachers regarding ICT usage in education, different types of instructional methods, their attitudes to foreseen or real problems and problem-solving strategies.

5.4 Students

To understand whether or not the F@tih project succeeds for students, the grades of students both before and after the project could be compared. Besides, based on the objectives of the new curriculum, portfolios which will be prepared by students during the F@tih project could be analyzed in order to understand whether or not students gain from the objectives.

5.5 Discussion and Conclusion

Although there are many projects around the world regarding technology integration into education, Turkey has decided to start by equipping her schools with the appropriate technology apparatus. For this purpose, a variety of e-content software, tutorials, encyclopedias, animations, simulations, games etc. has been either developed or purchased for students, for use both within and outside of the classroom. Moreover, for teachers to become used to smart boards, a lot of e-content has been developed to enrich the interactive use of the devices. On the other hand, on-going face-to-face training is being conducted with the users of these new technological devices. In general, students are never given training but teachers are provided with short periods of training several times, but are still needing more. E-training modules and portals have been developed to help maximize the experience of teachers acquiring these competences.

In the autumn semester, all of these new ideas and approaches will be implemented in schools selected as pilot institutions. After that, based on action research results, the necessary improvements and re-implementations will continue.

It is believed that in the presentation the data for the first phase of research, at least, will be shared with the participants. The research results are expected to reveal both the successes of the e-training program and the ICT curriculum. Findings will be used to redesign or improve the existing structures for reaching the goal of effective integration.

References

1. Baron, G.L.: ICT competencies, for Students and Teachers: Dilemmas, Paradoxes and Perspectives – The French Case (n.d.)
2. BECTA: 21st Century Teacher: Are you Ready to Meet the Challenge? (2010) http://unesdoc.unesco.org/images/0015/001562/156207e.pdf (last checked 1/31/2013)
3. BECTA: Harnessing Technology, Next Generation Learning 2008–2014: A Summary. Department for Innovation, Universities & Skills (2008)
4. Bogdan, R.C., Biklen, S.K.: Qualitative Research for Education: An Introduction to Theories and Methods. Pearson Education Inc., USA (2007)
5. Chou, C., Peng, H.: Promoting awareness of Internet safety in Taiwan in-service teacher education: A ten-year experience. Internet and Higher Education. 14, 44–53 (2011)
6. Crock, C.: ICT Competencies for Students: Mandated / Meaningful Conundrum. Presented at the Australian Computers in Education Conference (2002)
7. Çardak, Ç.S.: The Investigations of Students' Interactions and Learning Levels at Blended Learning (2012)
8. Educational Testing Service (ETS): i-Skills: Digital Transformation A Framework for ICT Literacy. , International ICT Literacy Panel (2007)
9. European Commission: Key Data on Learning and Innovation through ICT at School in Europe. Education, Audiovisual and Culture Executive Agency (EACEA P9 Eurydice) (2011)
10. FATIH Project: About the Project, http://FATIHprojesi.meb.gov.tr/tr/icerikincele.php?id=6 (last checked 1/31/2013)
11. FATIH Project: Project Components, http://FATIHprojesi.meb.gov.tr/tr/icerikincele.php?id=14 (last checked 1/31/2013)
12. FATIH Project: Project Executive Board, http://FATIHprojesi.meb.gov.tr/tr/icerikincele.php?id=8 (last checked 1/31/2013)

13. Ferrance, E.: Themes in Education: Action Research. Brown University, Northeast and Islands Regional Educational Laboratory At Brown University (2000)
14. Fraillon, J., Ainley, J.: The IEA International Study of Computer and Information Literacy (ICILS). International Association for Evaluation of Educational Achievement (2011)
15. Gaible, E., Burns, M.: Using Technology to Train Teachers: Appropriate Uses of ICT for Teacher Professional Development in Developing Countries. InfoDev / World Bank, Washington DC (2005)
16. Gülbahar, Y.: Usage of Electronic Portfolios for Assessment. Handbook of Research on New Media Literacy at the K-12 Level: Issues and Challenges. pp. 702–719. Information Science Reference, New York (2009)
17. Henndricks, C.: Improving Schools through Action Research: A Comprehensive Guide for Educators. Pearson, Boston (2006)
18. Hramiak, A.: Online Learning Community Development with Teachers as a Means of Enhancing Initial Teacher Training. Technology, Pedagogy and Education. 19, 47–62 (2010)
19. Jung, I.: Issues and Challenges of Providing Online Inservice Teacher Training: Korea's Experience. International Review of Research in Open and Distance Learning. 2 (2001)
20. Köklü, N.: Eğitim Eylem Araştırması (Tr) – Educational Action Research (2001)
21. Marti, M.C.: Teacher Training in ICT-Based Learning Settings: Design and Implementation of an On-Line Instructional Model for English Language Teachers (2006)
22. Mills, G.E.: Action Research: A Guide for the Teacher Researcher. Pearson Education Inc., New Jersey (2003)
23. Michuez, P.: Is it Computer Literacy, IT, ICT or Informatics? Education for the 21st Century — Impact of ICT and Digital Resources. 210, 369-373 (2006)
24. Moseley, L.: The role of assessment (2012)
25. NAACE: Draft Naace Curriculum Framework Information and Communication Technology (ICT) Key Stage 3 (2012)
26. NAACE: ICT Framework: A Structured Approach to ICT in Curriculum and Assessment (Revised Framework) (2007)
27. Nutt, J.: Professional educators and the evolving role of ICT in schools: Perspective report. CfBT Education Trust (2010)
28. Sharpe, L., Hu, C., Crawford, L., Gopinathan, S., Khine, M.S., Moo, S.N., Wong, A.: Enhancing Multipoint Desktop Video Conferencing (MDVC) With Lesson Video Clips: Recent Developments in Pre-service Teaching in Singapore. Teaching and Teacher Education. 19, 529–541 (2003)
29. Steiner, J.: Why have a standard-based curriculum and what are the implications for the teaching-learning-assessment process? English Teacher's Journal (2012)
30. The International Society for Technology in Education (ISTE), National Educational Technology Standards for Students, http://www.iste.org/standards/nets-for-students (last checked 1/31/2013)
31. Thomas, L.G., Knezek, D.G.: Information, Communications, and Educational Technology Standards for Students, Teachers, and School Leaders. International Handbook of Information Technology in Primary and Secondary Education. pp. 233–348. Springer US, USA (2008)
32. Tomei, L.A.: Taxonomy for the Technology Domain. Information Science Publishing, USA (2005)
33. UNESCO: ICT Competency Standards for Teachers. United Kingdom (2008)
34. UNESCO Bangkok: Strategy Framework for Promoting ICT Literacy in the Asia-Pacific Region. UNESCO Bangkok Communication and Information Unit, Bangkok (2008)
35. XINMIN Science Academy: ICT Competency Standards for Students (2008) http://www.xinminsec.edu.sg/ict/joomla15/index.php?view=article&id=47 (last checked 1/31/2013)

36. Zhang, L.J.: Reforming a Teacher Education Program for PRC EFL Teachers in Singapore: Sociocultural Considerations and Curriculum Evolution. International Journal of Educational Reform. 13 (2004)