Importance of Integrating Information Technology Related Curriculum in American Inner City Schools

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IMPORTANCE OF INTEGRATING INFORMATION TECHNOLOGY RELATED CURRICULUM IN AMERICAN INNER CITY SCHOOLS

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Abstract

This paper examines the significance of integrating Information Technology (IT) into the inner city K-12 educational curriculum. Educational curriculum reform is eminent due to the major breakthroughs in technology, including mobile Internet, digital textbooks and cloud computation. Currently, some educational systems are starting to utilize IT. Examples of this are seen with: Technology-based educational reform efforts such as Huntsville City Schools Laptop Initiative and Geospatial Information Technology (GIT); Software-focused initiatives such as Apple Textbook Initiative and Barnes and Noble e-book editions for Nook; finally, structured/standardized professional development workshops or courses such as the Library of Congress Teaching with Primary Sources Program for K-12 educators. However, a consensus must be reached on how to properly integrate IT into the K-12 curriculums. Educators' ideologies differ when considering various avenues for IT integration. Furthermore, there are several barriers that inhibit the effectiveness of incorporating IT into the national educational system, such as: teacher-level, school-level and system-level. Some studies recommend a Technology, Pedagogy, and Content Knowledge (TPACK) framework as a solution to effectively incorporate technology into the curriculum. Lastly, information technology integration is a multi-faceted issue that requires the expertise of various educators, scientists and professionals. A seamless transition from traditional educational approaches to contemporary digital methodologies requires careful planning and proper training to ensure that students benefit from this new approach to education. The result of the research is to increase the numbers of minorities in the Science, Technology, Engineers, & Mathematics (STEM) fields by injecting IT into the K-12 curriculum in inner city schools.

Keywords: K-12 educational curriculum, Information technology integration, Digital methodologies, TPACK.

1 INTRODUCTION

The new millennium was the dawn of a new era in terms of technological advances. Technology impacts various aspects of our lives. In fact, President Obama believes that the key to enhancing our economy is by fostering education in the Science, Technology, Engineering and Mathematics (STEM) arena. Pres. Obama stated last year, "... We must create an environment where invention, innovation, and industry can flourish... I am committed to doubling funding for key research agencies to support scientists and entrepreneurs, so that we can preserve America's place as the world leader in innovation, and strengthen U.S. leadership in the 21st century's high-tech knowledge-based economy" [1]. Thus, federal policies are catering to the growing need for STEM based education that incorporates technology as a way to teach our 21st century youth. Moreover, the projected job growth for STEM careers is estimated to be three times as fast as job growth for non-STEM jobs [2]. Along with this, the Economics and Statistics Administration states that STEM workers are less likely to experience unemployment than their non-STEM counterparts. Finally, workers with STEM degrees tend to earn higher salaries regardless of if they work in STEM or non-STEM careers [2]. Furthermore, the numerous advances in technology have made our computers smaller, quicker and more accurate. From the premiere of the iPad three years ago, to the surge of smartphones in the market, mobile technology is permanently embedded in our daily lives. In fact, mobile internet, digital textbooks and cloud computation are three technological advances that can positively change our educational approach.
1.1 Mobile Internet

Currently, mobile technology is the most popular way to access the World Wide Web. In fact, over 80% of American adults own a cell phone, nearly half of American adults own a smartphone and a quarter of American adults own a tablet computer [3]. In addition to this, as of 2012, most people own a laptop (60% of American adults). These statistics are a testament to the prevalence of mobile technology. In our society, people are no longer confined to a stationary place in order to surf the Internet. Various devices such as smartphones, tablet PCs and iPods allow us to “take” the Internet with us.

![2012 Percentage of Americans that Own Mobile Devices](image)

It is apparent that the majority of Americans currently own a cell phone, smartphone or tablet computer of some sort. Further, 61% of adults own a laptop – this percentage now surpasses the percentage of adults that own a desktop computer, which is 58% [3]. Ultimately, we live in a mobile world, and almost everyone has access to information via the various mobile devices that are available to us. Therefore, integrating IT into the K - 12 school curriculum can be seamless because we live in the technology era.

1.2 Digital Textbooks

According to Steve Jobs, “textbook publishing was an "$8 billion a year industry ripe for digital destruction"” [4]. In our “paperless” society, digital textbooks and digital publishing once thought of as the distant future are already in existence. A major competitor in the digital publishing realm is Amazon. Amazon is creating a new K-12 education initiative, which focuses on distributing Amazon’s e-reader, Kindle and the free Kindle App to students [5]. Amazon feels that when students have access to books, it will foster a voracious appetite for reading. For the K – 12 curriculum, educational professionals can purchase Amazon Kindles to distribute to students. Kindle’s “Whispercast,” Amazon’s free self-service tool, allows teachers, professors and other educational personnel to manage the content on students’ distributed Kindles [5]. With Whispercast, educators can provide a safer browsing experience by blocking students from accessing offensive content on the web and social networks such as social networks, Facebook and Twitter [5]. Ultimately, digital textbooks allow students to take their books with them everywhere in a neat, light device. In addition to this, digital textbooks cost up to 60% less than original print textbooks; this can save a school district thousands of dollars for the school year.
1.3 Cloud Computation

Cloud computing is an economical and flexible resource the educational system can use for storage, programs and other resources. Microsoft now offers cloud computing services specifically for educational services. In fact, at Florida Atlantic University, a Linux-based curriculum management application, Blackboard, was implemented in 2008 in order to reduce costs, manpower and enhance the student computing experience [6]. The Linux-based Blackboard was applied using “Hyper-V technology in the Windows Server 2008 R2 Enterprise operating system with Service Pack 1” [6]. In the end, FAU managed to reduce their IT costs by $600,000 while delivering quality computing services to the many students, faculty and staff across campus [6]. Another, cost-effective alternative to the cloud computation resource is open source software (OSS). OSS is increasing in popularity for many businesses because it offers companies more flexibility with low costs [7].

<table>
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<tr>
<th>5 Top Open-source Cloud Computing Software Applications</th>
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<tr>
<td><strong>Eucalyptus</strong></td>
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<td><strong>RedHat</strong></td>
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<td><strong>Puppet</strong></td>
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<td><strong>Zoho</strong></td>
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Companies can reduce their energy costs by 28% when adopting cloud services. Many companies spend nearly $20,000 a year in energy bills, outdated hardware and servers were a direct cause of this expense. However, cloud computing can save a company over $5,500 a year in IT expenses because cloud computing eliminates the need for a local server; employees can telecommute and work away from the business premises; finally cloud computing reduces a company’s carbon footprint because hardware and server maintenance is handled offsite [8].

2 INFORMATION TECHNOLOGY (IT) IN EDUCATIONAL SYSTEMS

IT in education is allowing students, teachers and other professionals to connect in a way never done before. Students can easily share information amongst one another using various mobile devices such as laptops, tablet computers and even smartphones. For teachers, IT allows them to use a plethora of multimedia tools, software and applications to add an in depth perspective to each lesson.

2.1 Huntsville City School Laptop Initiative

This case study illustrates the implementation of a new, purely digital curriculum for the Huntsville City School District in Alabama. Before the fall 2012 semester, HCS Superintendent Dr. Casey Wardsynski, announced that every student in the HCS District will receive a “free,” or borrowed, laptop for the school year [9]. Dr. Wardsynski intended to close the “digital divide between those with Internet access at home and those without” [9]. According to Board of Education professionals, students can download their homework at school via wi-fi and complete their assignments at home. In fact, Wardsynski articulates that increasing student participation and engagement in their studies was a driving force for the inception of the citywide laptop initiative. In the end, Huntsville, AL is the largest public school system to deliver laptops and tablets to each student in the district. Pearson, a leading textbook publishing company, has acquired a six-year $20.7 million contract with Huntsville’s Board of Education in order to provide digital content for the mobile devices [9]. On the contrary, there have been a few setbacks with the transition from a traditional “pencil-and-paper” curriculum to a purely digital one. There are still 30% of students that do not have in-home internet access; intense digital education training is still needed for teachers and staff; lastly, an efficient way of replacing damaged laptops is needed [9]. Also, teachers are noticing that keyboarding lessons and eye exams may be
needed for students in the future [9]. The HCS Laptop Initiative is a work in progress, but a step in the right direction.

2.2 Geospatial Information Technology (GIT) – supported Science Curriculum Initiative

This case study examines the effects of using Geospatial Information Technology (GIT) – supported science curriculum in an urban middle school in the northeastern United States [10]. GIT products include virtual globes, like Google Earth, and Remote Sensing (RS) satellite imagery. Teaching GIT is important because according to a published report by the National Research Council, there is a large void in the K – 12 curriculum for teaching and learning spatial thinking; yet GIT is a significant part of the National Science Education Standards [10]. Dr. Alec Bodzin, associate professor of Science Education at Lehigh University in Pennsylvania, used five 8th grade earth and space science classes in order to test his GIT-supported science curriculum [10]. He wanted the students to gain a better understanding of land use change (LUC) concepts and enhance their ability to apply spatial thinking [10]. After analyzing the collected data and daily observations of the 8th grade students, Bodzin determined that a GIT-supported science curriculum, using tools like Google earth and RS satellite imaging, enhanced the students’ ability to apply spatial thinking associated with LUC concepts [10]. Student engagement was found to be higher once the LUC unit concepts were incorporated into the curriculum; tasks that involved Google Earth showed higher percentages of student engagement [10]. This study further corroborates the theory that properly implementing technology to the K – 12 curriculum can positively impact students’ learning ability by reinforcing certain concepts.

2.3 Apple and Barnes and Noble Digital Textbook Initiatives

Apple recently announced that they are working on a new standard for its iBooks platform, ePub 3. ePub 3 encompasses a number of HTML5-based extensions which may allow iBook to be more compatible with other e-reader platforms [4]. Moreover, “social learning” is believed to be a beneficial tool students can use with their e-books. Dr. William Rankin, technology-in-education expert, states that e-books and digital texts allow students to interact with the information visually, such as links to supplementary material, 3D figures, graphs and videos [4]. Rankin further states that students can “share those connections with classmates” [4]. Social networking and the convergence of education in a user-friendly interface is what Rankin envisions in the near future for digital books. In the end, basic knowledge, such as the K – 12 curriculum, could be easily published and distributed for a fraction of the traditional paper-printed version. Barnes and Noble is entering the digital publishing business by introducing Nook, an e-reader and app by Barnes and Noble’s for e-books. Unlike Amazon, e-textbooks for Nook can only be downloaded on a laptop or desktop through the Nook App, not on the actual e-reader device [11]. So students do not need the Internet after the textbook is downloaded to their PC or Mac laptop. Finally, students can purchase or rent textbooks at a significantly reduced price.

3 K-12 TEACHER LIBRARY OF CONGRESS IT DEVELOPMENT PROGRAM

As the K – 12 curriculum migrates from traditional “pencil-and-paper” to a digital medium it is important to note that teachers should be trained in order to properly implement this new curriculum effectively. The Library of Congress’s Teaching with Primary Sources (TPS) program aims to train K – 12 teachers on how to adequately search for and teach newly digitzed primary sources [12]. Educators at Utah State University (USU) saw the importance of training K – 12 educators how to properly find and use digital primary sources in order to enhance the students learning experience [12]. In fact, Google has made it a personal mission to digitize the world’s books, specifically books that are no longer printed, while still respecting the copyright of said books [13]. The teacher’s that participated in this study visited a museum and a library’s collection of “significant national I and local digital collections of primary sources,” such as period pieces like Civil War era paintings and sheet music [12]. The USU professors collected data gathered from the workshop participants, analyzed their findings and concluded that proper technological training is vital in order for teachers to sufficiently teach their students how to gather information through a digital library platform [12]. In fact, the study illustrated that some teachers were not equipped with certain basic technology skills and was unable to keep up with the remaining workshop participants [12]. In the end, the study suggests that assuming each teacher has a basic understanding of technology is erroneous thinking; and a technology skill module for teachers may be a solution to the varying technological skill levels of K – 12 teachers [12].
4 BARRIERS PREVENTING PROPER INTEGRATION COMMUNICATION AND TECHNOLOGIES (ICT) INTEGRATION INTO K – 12 CURRICULUMS

Integrating IT into the K – 12 curriculum is filled with several obstacles; hopefully, by recognizing these barriers through various trials and studies, these hindrances can be significantly reduced. Teacher-level barriers are a huge influence when it comes to integrating Information Communication and Technologies (ICT) into the primary education curriculum [14]. Teacher’s negative and/or positive attitudes greatly influence their use of ICT in their lesson plans [14]. Teachers with positive attitudes towards technology in education tend to apply more to their own personal curriculum for their students [14]. School-level barriers influence how effectively ICT is integrated into the K- 12 curriculum, also. Obviously, tangible aspects, such as support, funding, facilities and training, impact teachers’ use and integration of ICT into their classrooms [14]. Teachers’ competencies in ICT are vital for proper ICT integration into the curriculum and student learning. Lastly, technological barriers that can impede ICT incorporation into the curriculum include the rate at which the technology is updated (i.e. Windows Vista vs. Windows 7 vs. Windows 8) and the user-friendly appeal of adopting a new program. Technology is constantly updated; consequently there must be a protocol in place to stay abreast with current technology [14]. Finally, new programs must be user-friendly in order for teachers to adopt these programs into their personal curriculum [14]. Once teachers have acclimated to a particular program, it is sometimes difficult to foster change; however, proper training, and well-designed program may invoke interest in teachers to try such program for their classes.

5 TPACK SOLUTION FOR IT INTEGRATION

Technological Pedagogical Content Knowledge or TPAK is a framework created for teachers to follow in order to properly introduce IT aspects to their curriculum [15]. TPAK includes the integration of technological, pedagogical and content knowledge in order for teachers to effectively incorporate IT principles to their lesson plans [15]. This framework provides a standard with which to properly train teachers to adopt IT principles into their individual curriculums because TPAK “emphasizes the connections among technologies, curriculum content and specific pedagogical approaches” [15].

![Figure 2. Definitions of Content, Pedagogical and Technological Knowledge [15].](image)
Content knowledge is awareness about a particular discipline; teachers must be competent in their discipline in order to knowledgeably teach their subject to students [15]. Pedagogical knowledge is awareness and proper application about the practices and processes of teaching, learning, student-to-teacher interaction, educational purposes, goals, values and strategies [15]. Like content knowledge, effective teachers must apply the principles of pedagogy, such as classroom management, instructional planning and implementation, in order to efficiently teach their students [15]. Finally, technological knowledge is constantly evolving at a rapid rate; however, technological knowledge is the ability to understand and apply basic computer literacy skills in order to solve problems. Technological knowledge requires creativity and innovation in order to apply it effectively. In the end, TPAK is maximally effective when teachers apply technological tools that are relevant to the "students' content-related learning needs and preferences" and apply such tools only for that specific lesson study [15].

6 AMERICA'S TOP JOBS

When thinking about the long term goal of IT related employment it is necessary to view the Forbes 2013 Jobs List to understand the job demands. The number one position is software developer for applications and systems software with 70,872 jobs added since 2010, and overall 7% growth [16]. The number four position listed is computer systems analyst with 26,937 jobs added since 2010, and overall 5% growth [16]. The number six position listed is network and computer system administrators with 18,626 jobs added since 2010, and overall 5% growth [16]. In 2012, the number one position was software engineering with a midlevel pay of $88,142 [17]. The number nine position was computer systems analyst with a midlevel pay of $78,148 [17].

7 CONCLUSION

The integration of technology into the K – 12 curriculums is an immense process. Many aspects of the issue must be addressed in order for the transition to be seamless. Mobile devices, digital textbooks and internet access are all important aspects of this digital curriculum transition. As for hardware, students must have access to technological devices; this is seen in the Huntsville City Schools Laptop Initiative case study. By "giving" students laptops, education professionals are introducing students to technology in a practical way. Software, especially open source software (OSS), is also vital to this digital curriculum transition. OSS is a cost effective way for educational professional to have a significant quantity of software for many students [18]. Currently, the majority of careers, especially STEM careers, require that employees are knowledgeable and able to efficiently use computers and software. Adding IT to the curriculum is important for preparing the future employees of this nation for careers in STEM disciplines. Again, in order to effectively apply IT principles to the curriculum, K – 12 teachers should be properly trained in basic computer literacy skills and given a framework, such as TPAK, for how to incorporate IT into their yearly curriculum. Further, a standard must be created in order to maintain technology at its most current state. Technology is constantly updating, so in order for IT to be effective, the most recent version of software must be available in order for students to positively profit from using the software. Finally, President Obama mentioned that the United States of America is moving away from the role of global production and manufacturing and headed towards the role of entrepreneurship and innovation. Integrating IT tools into the K – 12 curriculums is the primary step in order for America to be a country of STEM leaders, entrepreneurs, and innovators.

REFERENCES


