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The effects of information and communication technology on at risk children of low economic status: *Make It-Take It After-School Case Study*

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ABSRACT

The Institute for the Study of Digital Inclusion (ISDI) promotes digital inclusion through dispersion of computers and promotion of digital literacy to at risk children of low economic status within the State of Florida. The goals of this study were to determine: **1) Will providing students with relevant software and hardware skills and knowledge influence long-term academic performance? 2) Will digital literacy increase the student's commitment and desire to actively participate in future learning processes** ? Our findings indicate a direct increase in academic performance and participation in learning processes by students that completed the Make It-Take It After-School program.

Keywords: *Digital Inclusion; Academic Performance; Technology; Digital Divide; Digital Literac* y

INTRODUCTION

The study of digital inclusion was initiated to examine digital literacy, particularly those youth and their families in underserved communities, who, by definition, are generally considered the most "at risk" in these communities. The primary investigational procedure was to measure the academic progress made through digital inclusion and dispersion. Our study reflects that academic success is enhanced, as seen through the data collected, which in turn enables the student to develop into a more contributing member of society. The ultimate challenge for the digital inclusion process is to create new policies at the state and corporate level which may enable digital inclusion to be augmented while decreasing the digital divide.

The Jackson et al. (2006) study, "Does Home Internet Use Influence the Academic Performance of Low-Income Children," found a direct correlation between home internet use and standardized test scores; higher standardized test scores were reported for children who increased their home internet use. The study concluded that home internet use can enhance children's academic performance and further mentions that children using the internet require some degree of reading. This could explain the higher levels of development in reading skills compared to children not using the Internet. Jackson et al. references a previous study (Subrahmanyam et al. 2000, 2001) that points to the potential for improved spatial skills through the use of video games. However, the long term learning benefit of computer game use was determined to be inconclusive. In comparison, the Jackson et al. study concluded that increased home internet use has a direct correlation with standardized test scores of low-income children. Further theories on why certain academic areas were affected by computer use will require more research.

According to the Information Economy Report 2007-2008 by the United Nations (UN) the economic, social, and political challenges resulting from the digital divide are undisputed (UN Conference on Trade Development, 2008). The UN report recognizes that "[i]n the context of a global economy driven by technological innovations, it is important for developing countries to lay proper foundations for building their capacity to acquire and create knowledge and technology in order to take advantage of the opportunities offered by globalization and, at the same time, to

address emerging global challenges." (UN, p.1) The imbalance of resources and skills needed to effectively participate as a digital citizen in the rapidly emergent global economy has become clear, and the effect of the digital divide are no longer disputed, as reflected in the Jackson et al. study. The UN report further states that, "the challenge is therefore to harness knowledge for development" and to "disseminate" resources such as information technology throughout developing nations (UN, p.1). The UN report emphasizes the "importance of open access to knowledge" and "the importance of diffusion and sharing knowledge and technology" (UN, p.1).

Although the efforts made by the United States, similar to the UN, have made great attempts to close the digital divide, the current political system lacks essential fundamental tools in developing and adopting a process. The progressive nature of bridging the digital divide requires further awareness of external factors that can be influential in implementing processes. The process of assisting communities in the development of citizens that have the proper training to contribute to the digital society is increasingly recognized as a priority (ICT Report, 2002). The systematic effort to bridge the digital divide needs more attention in order to successfully obtain the objective of a more digitally enhanced society.

MAKE IT-TAKE IT AFTER-SCHOOL CASE STUDY (MITIAS)

The Make It-Take It After-School (MITIAS) case study was designed in an effort to accurately identify successful alternatives that increase cognitive and work skills associated with computer ownership and use. Some studies found that relationship between technology use and academic performance are difficult to establish (Blanton et al 1997), and some research unequivocally pointed out that having a computer at home is a predictor of academic progress (National Center for Educational Statistic, 2000).The MITIAS examines the effects of digital inclusion and dispersion in the development of academic skills of middle and high school students within the Central Florida school system in order to establish solutions to resource and development challenges experienced by lesser developed communities.

The MITIAS study takes many of the previously mentioned studies, as well as studies such as the benefits of active learning techniques versus traditional teaching methods (McCarthy, 2000), and improving educational outcome of at-risk children by participating in active and community learning (Project TELL, 1990-1997) as a starting point to further identify external factors that, in conjunction with computer use, engage the student and thus contribute to improved academic performance.

The key assumption was that children will engage in active learning as they are given access to digital information. This type of instruction distinguishes itself from other teaching methods in two ways: first, the process to acquire knowledge is learner driven, although not without guidance. Second, the learner learns by doing. The student will seek information that is immediately relevant to him or her and then also apply it to additional learning experiences outside of the direct computer environment.

Supporters of active learning believe that students who actively engage with the material are more likely to recall information later and will be able to use it in different contexts. The critics of this approach say that learning without formal guidance tends to be slow and frustrating. The McCarthy et al. (2000) report discusses two studies that compared traditional teaching methods and active learning. The report reflected higher standardized test scores from the students who were involved in active learning than from the students exposed to traditional teaching methods.

The benefits and disadvantages of access to digital information applied to active learning are outside the scope of this paper. Instead, this study will focus on identifying a research process

that will objectively measure changes in a student's academic performance before and after completing the program.

Hypothesis I: Providing the children with basic computer software and hardware skills and knowledge influences long-term academic performance.

The MITIAS program was organized as a four-week session with two phases, each lasting two weeks. The first phase concentrated on software and overall computer skills and the second focused on hands-on work with computer hardware. At the end of successful completion of the program, the student was provided a computer to take home and furnished with one year of internet connectivity. Both the hardware and internet connection are furnished by corporate sponsors.

Hypothesis II: digital literacy will increase student's commitment and desire to actively participate in the learning process.

The first two-week phase of the MITIAS program was designed to teach the children basic computer skills while instilling confidence and engaging the children in a positive way. This allowed students to gain familiarity with commonly used software applications while they developed "real world" skills.

The second two weeks of this study was designed to give the student hands-on experience with computer hardware. A lab environment was created with a computer workstation for each student. During the two-week period, the students removed each component of the computer and learned how to form a working unit. Once the computers were disassembled and the students had gained an understanding of the individual components, they begin the process of reassembling the computer. The technical problems, inherent to the process, provided the students with real world troubleshooting skills. Once reassembled, the students introduced new hardware and software to the system.

The MITIAS study assumes that hands-on experience will lead the children into claiming ownership over their progress and result in a desire to continue learning as well as the ability to further utilize that learning in additional areas. Additional learning may be through alternative computer classes or through self-driven exploration of the internet. Utilization of the information includes the ability to react and respond in a more in-depth manner when confronted with technology. The subjects ultimately examined by the students are not important. What is relevant in this study is that the children are exposed to processes that enhanced the development of functional and literary skills necessary to operate in a working society.

The MITIAS study also concludes that small class sizes help students develop interpersonal relationships with the staff which provides a foundation for students to increase confidence in their success. The study also utilized informal collaborative partnerships which have been established with other community agencies and enlisted them to provide an infrastructure of family support in order to broaden the sense of responsibility for student and family success.

METHODOLOGY

Sampling

A total of four hundred and fifty middle school and high school children participated in the study and were randomly assigned to either the study group or the control group. The data was collected over the course of the 2001-2007 school years. Each student had to meet the specific criteria for low income and high risk, categorized by valid participation in a schooling allowance program, a grade level average near, at or below 2.0, or lower than average writing, reading and mathematics state standard (FCAT) assessment scores. Students in Florida are required to satisfactorily pass the FCAT standardized tests as one of the prerequisites for a high school diploma. To accomplish absolute randomness, the students were assigned a random number to prevent unbiased opinions of the results.

Hypothesis III: The academic scores of the control group will remain constant with little variation.

Measurement

Each student in the study group and the control group was assessed and a pre-program baseline was established for four specific measurements; the student GPA, writing ability, reading comprehension skills, and mathematical ability. Grade Point Average (GPA) is an effective component of any educational performance indicator as it relates directly to a student's performance in the classroom. It is readily available and can be obtained without the need of cost-intensive research methods. Nonetheless, the GPA must be used in conjunction with other objectively quantifiable indicators that encompass more aspects of the environment in which a student functions. The writing, reading and mathematical assessments are also quantified by Florida FCAT standards throughout a student's academic career. Low FCAT scores also identify a student as high risk. At specific grades, a student is required to repeat a grade or potentially is not allowed to graduate until a specific average baseline score is achieved.

At the completion of the MITIAS, all students were assessed a second time and the results were compiled for the pre- and post- program environment. The same pre- and post assessments were used for program study group and the control group. The results for each of the four defined areas were considered and compiled independently, as it is possible that the MITIAS program only has a positive impact in certain areas of learning and not others.

For purposes of the statistical analysis, two independent sets of data are presented: 1) score differences for the control group and 2) score differences for the program group. If the program actually has a positive effect on academic performance, then the score differences for the program group will be larger than the control group.

RESULTS AND ANALYSIS

Control Group

The data reflects (Figure 1) a minimal yet notable increase in the control group GPAs, writing, reading comprehension skills, and math assessments. Although these increases are slight, we will assume external forces or simply repeating the test are the primary reasons behind the variation in scores.

RESULTS OF PRE- AND POST ASSESSED SKILLS					
	Control group				
	GPA	***Writing***	***Reading***	***Math***	
Average:	0.1714	0.08	0.126	0.1418	
St. dev:	0.05258989	0.9951397	1.74631618	0.1920405	
VAR:	0.0027657	0.99030303	3.049620202	0.03687956	
N	450				
	Study group				
	GPA	***Writing***	***Reading***	***Math***	
Average:	0.23	0.24	0.28	0.27	
St. dev:	3.3405E-16	3.38201E-16	3.5612E-16	3.4405E-16	
VAR:	1.1159E-31	1.4139E-31	1.9159E-31	1.7159E-31	
N	450				
Degree of confidence:					0.95

Figure 1: *Results of Pre- and Post assessed skills.*

Study Group

The participant study group recorded more substantial increases in all four categories tested. An increase of twenty-three percent was noted in the GPA, followed by an increase of twenty-four percent in writing skill development. These figures are interesting because the GPA and the writing skills do not directly correlate with the skills worked on during the program. It is believed that the increase in the GPA and writing areas were a secondary affect of the program and were due to the focused, teacher-directed learning and small-class environment. As mentioned previously, a student provided with a small-class size, and a directed, stable and encouraging learning environment will show an increase in confidence about their ability to succeed. It is believed that this confidence in success provided by participation in the directed, hands-on program carried through as initiative to succeed in the academic areas just mentioned.

More significantly as related to the MITIAS program, the participant group reflected even greater improvements in the enhancement of reading and math skills. The creative and analytical skills required to complete the program activities of building a computer and using the computer software specifically appear to have directly affected the children's capabilities in the math and reading areas. An increase of twenty-eight percent in reading scores and twenty-seven percent in math scores are encouraging results and clearly support the impact of the program on children's academic performance.

All measures were calculated using a ninety-five percent degree of confidence to determine if in fact, the results could be attributed to the program. It is our conclusion that the data collected and the results reflected above accurately and assuredly echo the original hypothesis that digital inclusion will positively influence the academic performance.

CONCLUSION

The Make It-Take It After-School study indicates that the development of critical analysis and cognitive thinking skills, through digital dispersion, could greatly impact the academic performance of low income, at risk children and increase a student's desire to actively participate in learning processes. Furthermore, these initiatives could lead to development of better consumers, responsible citizens, quality employees, and promotion of active self-governance. The private sector, educators and local and national governments must seize this moment of extraordinary opportunity to lead the way in helping children, who are now outside or on the periphery of the Information Age, to become full participants in tomorrow's global, knowledge-based society.

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