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The Relationship Between ICT Accessibility At Home And The Academic Performance Of Primary School Pupils In The Savannah Region Of Togo

[Accès Des TIC À La Maison Et Performances Scolaires Chez Les Écoliers De La Région Des Savanes Au Togo]

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Abstract: This research aims to establish the relationship between home access to ICT and the academic performance of primary school pupils in French and Mathematics in the Savannah Region of Togo. The methodology used in this research combines quantitative and qualitative approaches. Thus, a total of 561 pupils from the Primary school levels—specifically Primary 4 and Primary 6 pupils were surveyed, comprising 264 boys and 297 girls aged between 7 and 15. Moreover, 15 teachers and 20 parents participated in individual interviews. The findings reveal that pupils who have access to and use ICT at home achieve satisfactory results in French. The same applies to Mathematics.

Keywords: ICT (Information and Communication Technology), academic achievements, primary school pupils, Savannah, Togo.

Résumé : Cette recherche vise à démontrer le lien qui existe entre l'accès des TIC à la maison et les performances des écoliers en français et en mathématiques de la région des Savanes au Togo. La méthodologie adoptée combine les approches quantitative et qualitative. Ainsi, 561 élèves des classes de CE et CM, plus précisément CE2 et CM2 ont été interrogés dont 264 garçons et 297 filles ayant un âge compris entre 7 et 15 ans. Par ailleurs, 15 enseignants et 20 parents d'élèves ont subi des entretiens individuels. Les investigations révèlent que les écoliers qui ont accès et font usage des TIC à la maison obtiennent des résultats satisfaisants en français. Il en est de même pour les mathématiques.

Mots clés : TIC, performances scolaires, écoliers, Savanes et Togo.

Introduction

The use of technology offers several advantages for both teachers and learners. It provides access to a vast amount of information, images, and stimuli. *"ICTs provide innovative means not only for disseminating knowledge but also for exploring learning strategies that foster the development of competencies"* (M. Lebrun, 1999: 43). ICTs encourage the adoption of a pedagogical approach that places the student at the center of the learning process. The teacher is no longer the sole repository of subject-specific knowledge; they become *"a mediator between knowledge and students, a collaborator in learner success, and a catalyst for development"* (H. Knoerr, 2005: 53). Furthermore, technology facilitates the creation and management of teaching tools by

providing teachers with real-time access to high-quality, abundant documentary resources. This process of pedagogical creation and management helps develop the teachers' technological skills and boosts their motivation.

Moreover, teachers use technology to significantly enrich their lessons through multimedia presentations, which offer various resources related to the subject matter—or assignment instructions—that can be accessed anytime, anywhere. *"Teachers who use multimedia in their teaching-learning activities show a positive increase in their perceived level of competence"* (B. Poelhuber, 2001: 10).

Using technology for teaching allows learners to explore new perspectives and discover a new mode of instruction. It offers them an opportunity to enhance their knowledge. Thus, ICTs—primarily thanks to their multimedia features—facilitate: *"Problem-based learning; cooperative learning, and the emphasis placed on collaborative forms of learning and teaching; project-based pedagogy, for the holistic development of the learner."* (H. Knoerr, 2005: 55).

Furthermore, Information and Communication Technologies stimulate the development of the learners' intellectual abilities such as their capacities for critical thinking, problem solving, learning and creating. Besides, in addition to facilitating the search for more comprehensive information on a topic, the use of new technologies fosters collaboration—both among students within the same class and between students or classes from different schools, whether nearby or far apart—thereby raising awareness of other realities. Moreover, the many options offered by new technologies—such as simulation, virtual manipulation, the rapid linking of diverse data sets, graphic representation, and much more—help connect knowledge with various facets of the individual and ensure a deeper mastery of the material being learned. For instance, students attending multimedia-enhanced lessons have the opportunity to participate in more dynamic presentations that incorporate images, music, charts, animations, and simulations.

In Africa, the integration of ICTs—and the Internet in particular—into education systems, while relatively recent, has been acknowledged by education institutions as a key factor in shaping educational policies. ICTs, thus, represent a main strategy for achieving the goals of Education for All (EFA). Indeed, according to Mbangwana et al. (2006), current discussions within UNESCO—acting as the coordinator and impartial advisor for EFA—focus largely on the role of ICTs in advancing the EFA agenda. This view is shared by the World Bank, which considers the integration of ICTs, and the Internet specifically, essential for the development and quality of education in Africa.

For many researchers, ICTs—as a pedagogical tool—can foster innovation in teaching and boost learners' motivation, enabling an educational environment where every child can, in a sense, learn at their own pace. Furthermore, they argue that in the face of teacher shortages, ICTs play and will continue to play a major role in training. They also allow teachers and students to expand their learning circles beyond their immediate geographical areas by accessing virtual spaces for sharing knowledge and experiences. Teachers and professors can consult colleagues, exchange content, and collaborate on developing innovations. Learners can cross new boundaries, discover realities elsewhere, and share their own perspectives with others.

According to A. Dimitracopoulou et al. (2004), higher-order cognitive processes can be developed when students are taught to apply technology to problem-solving. From this perspective, P. Perrenoud (1998) proposes a rapid deployment of resources provided by ICT in education, aiming to equip learners with tools for thinking and for putting knowledge into practice. These include digital textbooks, as well as browsing and independent study tools capable of adapting to learners' levels, goals, and learning needs; simulators, expert systems, platforms for collaborative work, communication networks; and databases and information repertoires containing updated and validated information.

Authors such as D. Jonassen (1996), R. Kozma (1994), R. Pea (1985), or G. Salomon (1993) have indeed made significant contributions to demonstrating the potential of ICT—for instance, in guiding students to manipulate concepts, representations, or models.

In light of this literature, it is clear that ICTs have a positive impact on learners' academic output. Our study aligns with this perspective, placing particular emphasis on their use within the family setting. Thus, this research aims to analyze the relationship

between home access to ICTs and academic performance—specifically in French and Mathematics—among schoolchildren in the Savannah Region of Togo. To achieve this objective, the following methodology was implemented.

1-Materials and Methods

1.1. Study setting and participants

The study was conducted in the Savannah Region in the northern part of Togo and it involved six primary schools: the Camp Gendarmerie Public Primary School, the Dapaong Central Public Primary School, the SOS Secular Private Primary School, the Franco-Arabic Islamic Private Primary School, the Bon Pasteur Faith-based Primary School, and the Shalom Faith-based Primary School.

Furthermore, the survey focused only on the Third-Fourth grade pupils and Fifth-Sixth grade pupils or classes, as we determined that pupils in the First-Second grade classes would be unable to adequately answer the questions they are asked. Consequently, 561 pupils from the Third-Fourth grade and Fifth-Sixth grade levels—specifically the Fourth-graders and the Sixth-graders—were surveyed; this group comprised of 264 boys and 297 girls aged between 7 and 15. Additionally, 15 teachers and 20 parents participated in individual interviews.

1.2. Data collection techniques

To gather information, we used questionnaires, interview guides, and tests. The questionnaires and tests were administered to the pupils, while the interview guides were used with teachers and parents. The questionnaire enabled us to identify the pupils who had access to ICT and those who did not.

The tests allowed us to assess the pupils' academic performance in French and mathematics. These tests were designed with the assistance of primary school teachers, taking the current curriculum into account.

In French, for example, the Fourth-graders assessments covered word order within a sentence, sentence structure, verb conjugation in simple indicative tenses, transforming sentences from the affirmative to the negative form, and vice versa, and building sentences using specific words and expressions. In the Sixth grade French class, the assessment questions covered verb conjugation in the past tenses of the indicative mood, identifying verb moods within sentences, transforming sentences from active to passive voice, and vice versa, identifying various sentence types, and concepts such as antonyms, synonyms, homonyms, and words belonging to the same word-root family.

In Mathematics, for the Fourth-graders, the tests covered ordering numbers from the smallest to the largest, standard operations with four-digit numbers, identifying various geometric shapes, converting hours to minutes and minutes to seconds, and writing numbers (in both numerals and words) ranging from 0 to 999,999. For the Sixth-graders, the assessments covered writing numbers (in numerals and words) from 999,999 upwards, conversions, and standard operations with numbers exceeding four digits. Each assessment lasted approximately thirty minutes. The tests were conducted under the same conditions as standard examinations. Following the assessments, the papers were graded on a scale of 10. Students scoring between 0 and 4 in either French or mathematics were classified as failing, while those scoring between 5 and 10 were classified as successful.

An interview guide was administered to 15 teachers and 20 parents of students within the sample population to gauge their perceptions regarding the impact of ICT on academic performance.

An example of question from the interview guide was: What is your opinion on the influence of ICT usage (computers, tablets, and smartphones) at home on students' performance in French and Mathematics?

1.3. Data analysis procedures

Quantitative data entry and processing were carried out using SPSS 20.0 software. The statistical methods employed included analysis of variance (ANOVA) and the calculation of Snedecor’s F-test. Qualitative data were analyzed using content analysis techniques.

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2-Results

This section presents, in tabular form, the relationship between the use of ICTs (considered as a whole) and performance in French and Mathematics.

Table 1: Relationship between ICT use at home and academic performance in French

Academic performance	Do you have ICT at home?	Number	Mean	Standard deviation	ANOVA
Mean score in French	Yes	299	1.70	0.458	t= 9.31; S_p=0.000; df=559
	No	262	1.34	0.473	

Source: Field survey results, November–December 2019

The data in the first table show that pupils who have access to ICT at home perform well in French (1.70) compared to those who do not (1.34). This difference is highly significant (t_{559}= 9.31; S_p = 0.000). Having access to ICT contributes to success in French.

Table 2: Relationship between ICT use at home and academic performance in Mathematics

Academic performance	Do you have ICT at home?	N	Mean	Standard deviation	ANOVA
Mean score in Mathematics	Yes	299	1.70	0.458	t= 10.44; S_p=0.000; df=559
	No	262	1.30	0.458	

Source: Field survey results, November–December 2019

Similar results are obtained in Mathematics. Indeed, the pupils who perform best in Mathematics are those who have access to ICT at home. Their average score is 1.70, compared to 1.30 for those who do not have ICT.

3-Discussion

Several recent studies have highlighted the potential of ICT to foster learning in school and university settings (OECD, 2004; ITU, 2004; C. Barrette, 2005; J. Kessel et al., 2005; S. Machin et al., 2006; T. Karsenti et al., 2008). In general, these studies emphasize the contribution of ICT to the understanding of course material, the solving of classroom problems and exercises—in short, to learners' educational success.

Some researchers, such as J.-M. Fourgous (2010), demonstrate that ICT has a positive effect on learning, noting that ICT in education (TICE) fosters student success (T. Karsenti, C. Raby, & S. Villeneuve, 2008).

Others—including F. Robertson et al. (1987), W. Sturtevant (1990), T. Lafferière et al. (1999), R. Chouinard and T. Karsenti (2003), M. Mbangwana and E. Ondoua (2006), P. Fonkoua (2006), and BECTA (2006)—maintain that ICT holds enormous educational potential capable of fostering and supporting students' learning activities. The British Educational Communications and Technology Agency (BECTA, 2006) asserts that the effective use of technology in schools can have a direct impact on students and their academic results. Analyzing data from the Pan-African Project on the pedagogical integration of new technologies, M. Djeumani-Tchamabe (2010) also presents ICT as having a positive impact on learning. Their potential is thus extraordinary (B. Matchinda, 2006; 2008) and their benefits considerable (L-M. Onguéné-Essono, 2006), acting as *"aids to the*

learning environment" (M. Mbangwana & E. Ondoua, 2006: 77). For the aforementioned authors, education would therefore benefit from integrating ICT into the school system and encouraging learners to make it their own (T-M-S. Tchombé, 2006).

Furthermore, information presented in multimedia format stimulates multiple senses simultaneously and, consequently, fosters better memory retention (F. Guay, 2001).

Among the other benefits provided by ICT, F. Jamet and A. Lieury (2000) note that it increases motivation and encourages learners to take a more active role in the learning process.

This facilitates the retention of connections between existing and new concepts. Indeed, K. Huffman and M. Vernoy (2000) indicate that factors promoting better retention include information presented in both verbal and visual forms (dual-coding system), in-depth analysis of information (level of processing), and information organization (e.g., concept maps). All these elements can be leveraged through the use of Information and Communication Technologies (ICTs).

Regarding learning theories, ICT aligns well with the process of knowledge construction. As J.-A. Tardif (1992, 1996) suggests, a key condition for achieving this is the student's active participation in the learning process. J. Désilets (2001) reaches a similar conclusion, noting that technology has the potential to make students more active learners.

Returning to our own findings and comparing them with the aforementioned studies, our results also reveal that the availability of ICT has a positive impact on academic performance.

However, these results diverge from the views of L. Cuban (1998), P. De Brem (1998), P. Lacerte (1998), and T. Russell (1999), who argue that computing technology offers no specific "pedagogical added value" to students' academic work. In an article aptly titled "Computers in Schools: What For?" P. De Brem (1998) reports that no benefit to learners has been scientifically proven. He maintains that it is difficult to establish a correlation between IT investments and academic results. Furthermore, he emphasizes that the introduction of new technologies into schools is driven primarily by economic and commercial considerations rather than by a fundamental educational or pedagogical rationale. It is in this vein that L. Cuban (1998) writes that when *"the computer meets the classroom,"* it is always *"the classroom that wins."* For authors who hold this view, *"the screen creates a cognitively detrimental distance between the student and the object of their learning"* (F. Poyet, 2009: 5). Simply putting information on the Internet is therefore not enough for students to acquire new knowledge; to think otherwise is to misunderstand the nature of learning (A. Dillon & R. Gabbard, 1998).

Nevertheless, playing games on computers, tablets, or Android devices enables children to develop certain cognitive abilities. These findings align with those of A. Lieury, S. Lorant, and F. Champault (2014). From a cognitive perspective, regular video game playing is often viewed positively (K. Subrahmanyam, P. Greenfield, R. Kraut & E. Gross, 2001; V. Sims & R. Mayer, 2002). Such activity may lead to improvements in attention and concentration, visual perception, visual memory, simultaneous processing, metacognitive skills (planning, strategy implementation), and information processing speed (P. Greenfield, 1998).

Furthermore, our results indicate that schoolchildren who have access to ICT at home perform well in French. Similar results are observed in Mathematics; indeed, the top performers in Mathematics are those who have access to ICT at home.

These findings corroborate those of A. Bork (1985), L. Nichols (1992), and K. Subrahmanyam, P. Kraut, R. Greenfield, and E. Gross (2000). As early as 1985, A. Bork predicted that the home computer could exert a central influence on the education system. L.-M. Nichols (1992) concluded that there may be a relationship between personal computer use and basic technological skills: students who use software at home show greater improvement in their technological proficiency. This technological competence has become so important in the 21st century that some authors classify it alongside criteria for basic literacy (B. Fernandez, 2005; L. Limage, 2006). These findings are also supported by C. Peck, L. Cuban, and H. Kirkpatrick (2002), who suggest that home computer use could open up learning opportunities and encourage students to persist in their studies.

Obviously the results of our investigations confirm findings from various other studies.

For instance, in a study conducted by P. Attewell and J. Battle (1999)—using data collected in 1988 from second-year secondary school students—having a computer at home was associated with several noteworthy effects: boys outperformed girls when using

the computer, and students from privileged homes derived greater educational benefits from computer use than those from disadvantaged backgrounds. Using data from the British Household Panel Survey conducted between 1991 and 2001, D. Schmitt and L. Wadsworth (2004) examined the relationship between home computer ownership and various academic outcomes. They analyzed data on youths aged 15 to 18. They concluded that students with access to a computer at home achieve better academic results, even when controlling for various external variables (socioeconomic status, region, individual characteristics, etc.).

D. Beltran and colleagues (2005) conducted analyses using three datasets: the Computer and Internet Use Supplements, the Current Population Survey, and the National Longitudinal Survey of Youth 1997. They focused exclusively on youths aged 12 to 16. The aim of their research was to determine potential relationships between home computer use, educational completion, grades, and deviant behaviors (school suspension, delinquency at school, etc.). In their sample (based on 2003 data), 81.1% of students had access to a computer at home. Even after controlling for a wide range of variables, the authors reported that having a home computer increased the likelihood of graduating from high school by 6% to 8%. Their study also indicated a significant positive relationship between grades and the presence of a computer at home. Overall, their findings suggest that students with a computer at home achieve better grades and have a greater chance of academic success.

L-A. Jackson et al. (2006) studied the relationship between Internet use and the academic performance of young children from disadvantaged backgrounds. Their study was conducted with 140 students—primarily African Americans aged 12 to 14—and concluded that students who use the Internet achieve higher reading test scores than those who do not use computers, a finding that supports the results of other studies (P. Attewell & J. Battle, 1999; D. Beltran et al., 2005).

However, the results are not always so conclusive. In this regard, J. Wittwer and M. Senkbeil (2008) report finding no significant difference between students who own a computer and those who do not. The study conducted by T. Fuchs and L. Woessman (2004) concludes, conversely, that the presence of a computer at home is negatively correlated with performance in Mathematics and reading.

Along similar lines, some authors conclude that time spent playing on the computer has a negative impact on academic success, as it interferes with studies (J. Harris, 2001; J-M. Smyth, 2007). According to them, the more time spent using a computer at home, the poorer the students' performance. This effect is reported to be more pronounced among younger and poorer students (J. Wainer et al., 2008).

Some researchers have highlighted the negative health effects of ICT use on learners, parents, and teachers—specifically regarding radiation emissions from various devices and, above all, Wi-Fi systems. These factors may foster the development of conditions such as eye and hearing disorders and even cancer, which in turn can affect academic performance (O-R. Akiyo, A. Afouda, T. Vigninou & B. N'bessa, 2013).

Furthermore, in his research on ICT (Information and Communication Technologies) and academic learning deficits among students at the Agoè-Nyivé high school in Lomé (Togo), B. Houloum (2019) demonstrated that excessive ICT use by learners negatively influences their learning process and, consequently, their academic performance.

Conclusion

The aim of this research is to establish the relationship between ICT and the academic performance—specifically in French and mathematics—of primary school pupils in the Savannah Region of Togo. The initial hypothesis was that a relationship exists between ICT and pupils' academic performance. A methodology was adopted that yielded the following results.

Pupils with access to ICT at home perform better in French (1.70) than those without such access (1.34). This difference is highly significant ($t_{559} = 9.31$; $S_p = 0.000$). Access to ICT facilitates success in French. Similar results were observed in Mathematics; indeed, the top performers in Mathematics were pupils with access to ICT at home. Their average score was 1.70, compared to 1.30 for those without access.

However, we acknowledge that this study focused exclusively on primary school pupils. Future studies could examine secondary school students.

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