

The Mediating Role of Individual Performance in the Interplay between ICTE Appropriation and Educational performance

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[Doi: 10.19044/esipreprint.8.2024.p264](https://doi.org/10.19044/esipreprint.8.2024.p264)

Approved: 14 August 2024

Posted: 15 August 2024

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OPEN ACCESS

Cite As:

Mdarbi, S., Simour, L., Boufarouj, C., Belkebir, Z., Stili, K., & Ennadi, M. (2024). *The Mediating Role of Individual Performance in the Interplay between ICTE Appropriation and Educational performance*. ESI Preprints. <https://doi.org/10.19044/esipreprint.8.2024.p264>

Abstract

Over the past two decades, higher educational institutions have invested heavily in information and communication technologies (ICT). Since the advent of the Internet, ICTs have significantly impacted university organization, teaching, and learning methods. A key research question

concerns the impact of students' appropriation of ICTs on educational performance. Scholars have explored this question both theoretically and empirically but faced two main constraints. First, it is challenging to observe students' ICT appropriation due to unclear definitions. Second, the evolving nature of ICTs makes isolating their effects difficult. This study aims to explore the contribution of students' ICT appropriation to educational performance in universities and to define the role of Individual Performance in the relationship between ICT appropriation and educational outcomes. Based on a quantitative survey of students from public universities in the Casablanca-Settat region, the study used the structural equation method (SEM) with SMART PLS 4.0 software. Data from 185 students revealed a direct correlation between ICT adoption and educational performance, with individual performance acting as an intermediary. The findings indicate that ICT profoundly influences the learning process in higher education. Future research should focus on the individual performance of Moroccan university students and its impact on their educational outcomes.

Keywords: The use of ICT in Education, appropriation of ICT in Education, educational performance, university students, Moroccan context

Introduction

Over the past two decades, Moroccan higher education institutions have been giving great importance to information and communication technologies (ICT). ICTE has had a major impact on the university context, particularly with regard to teaching and learning methods. Indeed, since the implementation of a series of digital strategies and programs for the pedagogical integration of ICT, Morocco has witnessed an increase in the skills development of its higher education system.

A national policy has been launched to promote the widespread use and integration of ICT in the educational system. Key achievements include the availability of computer facilities in the majority of schools, secondary and higher education institutions; the extension of Internet access, particularly to universities, and the organization of workshops and training courses for all stakeholders in the educational system. Certainly, there is still much to be done to overhaul the field of education and training in order to improve the students' learning and to live up to the impending requirements of the digital world. A confounding research issue arises as to the effective impact of these technologies on the student's success and on the performance of the educational system.

Several researchers have attempted to answer this question at the theoretical and empirical levels, particularly in academic settings Pierson M.E (2001); Paivandi S, (2018). They have encountered two main

challenges. On the one hand, it is difficult to track individual student performance while confusion still remains over its definition. On the other, the ICTs are evolving over time and their effects are quite difficult to isolate in a given context.

ICTs seem to be profoundly affecting the learning process in higher education, offering new opportunities for university students. These can have an impact on the students' performance and achievements. According to Ben Youssef A. and Dahmani M. (2010), there are contradictory results in empirical studies in this field, and these contradictions can be explained by a long process of appropriation and exploration of the possibilities offered by the use of ICT in higher education institutions.

As a result, significant changes are slow in coming. This is the case in other economic sectors, as well as in higher education. Equally, the failure to bring about organizational change in higher education influences the performance of the educational system. Although universities have invested in technology and communications facilities, and the use of ICT is increasing among students, there has been very little change at organizational level. In Morocco, and worldwide, there is a lack of empirical studies on the impact of students' appropriation of ICTE on educational performance within universities. In this field of research, there is a similarly lacking consensus on the appropriation of ICTE by university students and its impact on the performance of the educational system. Hence the importance of addressing this issue.

We will attempt to define ICTE appropriation and educational performance in the context of a public university in the Casablanca-Settat region, by studying the correlation between these two variables. We will also examine the role of individual performance in the relationship between ICTE appropriation and educational performance. We will first present measures about ICTE appropriation, educational performance and individual performance. Secondly, we will study the relationship between these two variables and determine the role of Individual Performance in this relationship.

Our work will be based on a quantitative study of students at public universities in the Casablanca-Settat region. We have used the structural equation method (SEM), with the help of SMART PLS 4.0 statistical software.

Literature Review

Best use of ICTs

The meaning of the term "exemplary use" (or best use) generally refers to users who can serve as role models for other users. English-speaking authors use a variety of phrases and expressions to refer

specifically to those users who integrate ICT in an ideal way into their work processes. These include "experienced and accomplished teachers at integrating computers into their teaching" Sheingold and Hadle (1990); "exemplary computer-using teachers" Becker (1994); "exemplary technology-users" Parks and Pisapia (1994); Pierson (2000); "exemplary technology teachers" and "exemplary technology-using teachers" S Berg et al. (1997). Within the same vein, we emphasize "proficient technology-oriented teachers" Roblyer et al. (1997); "expert users of computer resources" Becker (1999); "exemplary technology integrators"; "exemplary technology-integrating teachers" Pierson (2000) by Raby C. (2004, p. 41).

For Becker, H.J. (2000, p. 275), a series of studies has identified significant factors that appeared to be different in the environments of exemplary computer-using teachers, including developmental activities, staff support, smaller class sizes and access to software. The studies have highlighted the potential influences of the increase in extrinsic enablers, and further attention needs to be paid to intrinsic factors Becker (1991).

According to Berg, Benz, Lasley and Raisch (1998), an exemplary use of ICT is due to the technology's ability to provide learners with the tools they may need to actively process, transform and appropriate new information Ertmer P.A. et al. (2006, p. 55).

For Pierson M.E. (2001, p. 414) users, especially exemplary technology teachers, spend a great deal of time working with digital tools, but they also have had training and experience, as well as very high levels of innovation and confidence. Colleagues who use computers for meaningful activities surround them; they have support at the school level, and they are offered many opportunities for personal growth.

The pedagogical integration of ICT into the teaching field cannot, however, be regarded as a mechanical process; in concrete terms, it raises the whole fundamental issue of preparing and training - both administrators and teachers - for the optimal use of ICT in line with the improvement of teaching and student learning in a purposeful learning context.

However, Raby C. (2004, p. 44) has distinguished a new logic for the exemplary use of ICT while identifying four different stages and cycles: "raising awareness", "Personal" use, "Professional" use, and "Pedagogical" use.

"Awareness" refers to vicarious contact with the ICTs. These are experienced in the individual's personal or professional environments. The "personal" use level seems important as well. It refers to the use of ICTs in personal activities, such as communicating with family or colleagues, managing personal and family affairs, or even looking for information directly related to subjects of personal interest, such as finding a specific address.

With regard to "professional" use, this refers to the use of ICTs by individuals as part of their professional activities, but not in direct interaction with learners. For example, it reflects the use of a platform within the University for Communication with managers or administrative staff.

The "educational" use level is divided into five parts:

- 1) During the motivation process, teachers develop a curiosity, a need or a pedagogical obligation to integrate ICTs into the classroom.
- 2) During the familiarization phase, users prompt learners to use technical tools as a reward or occupation. Beyond emotional interest, the educational value of such activities seems limited to the initial and basic development of the students' ICT skills.
- 3) In the "exploration" phase, teachers use ICTs to enrich pedagogical content. Students then engage in activities to reinforce or enrich concepts taught in class, or to retrieve information to improve their learning level. In addition to acquiring knowledge, the activities also facilitate the development of transversal skills related to the ICTs.
- 4) During the "infusion" stage, teachers engage their students in the use of ICTs. This will enable them to develop disciplinary competencies and further develop competencies in the use of ICTs.
- 5) The final "appropriation" stage is characterized by the regular and frequent use of knowledge transmission and construction, carried out in an active and meaningful, goal-oriented learning environment.

In this respect, appropriation enables the development of disciplinary and cross-disciplinary skills for the various users.

Technology Appropriation

Adaptive structuring theory, or technology structuring and appropriation theory, defines the concept of appropriation as a set of processes in which users make use of technologies in different ways that are compatible with work requirements (DeSanctis and Poole, 1994). In the workplace context of the digital age, technology appropriation refers to the use of technologies in different ways to achieve organizational goals, using different IT tools and communication technologies. More concretely, it is about how a group uses, adapts and reproduces a structure Roux A. (2007, p. 4).

Ko E.J. et al. (2021, p. 2) define appropriation as the use of ICTs in various ways to achieve organizational goals DeSanctis and Poole (1994). It also argues that, when specific ICTs are accepted and used appropriately to meet task or organizational specifications, this leads to individual employee

performance as well as organizational performance DeLone and McLean (1992, 2003).

Educational performance: definition and context

Success versus failure is a social construct inherently linked to the specific context in which it is used. It is part of the categories used by the institution itself. Indeed, success in the educational system is based on the objective performance of the act of learning, and refers to institutional and administrative standards. According to Deniger (2004), educational success means achieving learning objectives linked to the mastery of knowledge specific to each stage of the educational pathway followed and, ultimately, towards earning a diploma or integrating into the job market by Arapi E. (2017, p. 68).

Success and failure play a significant role in educational institutions since they serve as a way to select, evaluate and categorize individuals. They are viewed as formal and "objective" measures of achievement. According to Perrenoud P. (2002), educational success is linked to how well someone performs academically. Success is determined by meeting high standards of excellence and by making progress in the curriculum. On the other hand, the concept of retention refers to the ability to stay enrolled in a course in higher education and successfully complete one's studies.

Educational performance often focuses both on the results achieved by students and on how they are measured by teachers, without taking into account what made these results possible, or to what extent they reflect the student's journey into studies. The selection of the measurements of educational performance determines the importance given to the individuals involved in university education. It also includes participation in seminars, conferences, workshops, professional training programs, research advisory boards, and so on.

If we are satisfied with the outcomes achieved by the students, such as grades and the successful completion of the academic year, then the evaluation conducted by the educational institution becomes the foundation for analysis. However, if we allow the students to provide their own comments, interpretations, self-assessments, and judgments regarding their evaluations, we incorporate the personal and subjective aspect of performance Paivandi S. (2018, p. 101).

Bodin and Millet (2011) criticize the concept of "failure." They view the university as a structured and diverse space for socialization, wherein student practices of reorientation or non-re-enrollment are shaped and organized in different ways.

Individual Performance

Research on educational performance can be categorized into three main areas when examining individual performance within organizations. “Learning productivity”, which explores the learning capacity of students and focuses on the individual's ability to learn. Researchers such as Johnstone (1993), Hooker (1997), and Kuth and Hu (2001) have contributed to this thematic concern by investigating various aspects of learning productivity.

“Academic experience”, on the other hand, concentrates on the learning environment and the overall experience of the students. Scholars like Astin (1985) and Kuth and Hu (2001) have examined how the student's environment and educational experience influence their individual performance. In other words, this aspect examines the impact of the learning environment on individual performance. “Teaching effectiveness”, however, aims to enhance student learning by proposing effective teaching methods. Researchers such as Chickering and Gamson (1991), Hativa, Barak, and Simhi (2001), and Sigmen (2006) have contributed to this issue by suggesting strategies and approaches that can improve the student learning outcomes.

Over time, the concept of individual performance has undergone multiple transformations and has extensively been studied. Researchers, including Borman, W. C., Motowidlo, S. J. (1997), Motowidlo (2003), and Agonhossou D.K. and Godonou C.K. (2011), among others, have fervently attempted to define individual performance. However, a universally accepted and unequivocal definition of this concept remains elusive. This challenge stems largely from the nature of academic research, which predominantly focuses on the criteria and methodologies employed in assessing individual performance.

However, Performance was defined as “Action or behavior that is relevant to the achievement of organizational objectives and that is measurable in terms of level of profitability” Motowidlo, S. J. et al. (1997, page. 99). This definition implies that they consider individual performance to be a key factor in organizational success. For Agonhossou D.K. and Godonou C.K. (2011), individual performance is “the total value expected by the organization from the discrete behavioral episodes that an individual performs over a given period of time” p. 109).

Hypotheses and Research Model

In 2020, Barragán Giraldo, D.F. and Amador Báquiro, J.C. carried out a study, covering the period from 2000 to 2019, on the appropriation of Colombian public policies around ICTs in education,. The results indicated that the implementation of a training process for university stakeholders that

centers around the use and appropriation of ICTs is essential for pedagogical innovation and the development of digital skills. This involves not only training the users, but also generating collective processes based on their experience.

Barragán Giraldo, D.F. and Amador Báquiro, J.C. (2020, p. 125) have noted that, in order to give meaning to possible improvement and innovation actions, it is necessary to involve the generation of meeting spaces, reflection and decision-making, and course sharing based on their practical knowledge.

Using a qualitative approach, the findings of a second study on the appropriation of ICTE indicate that the latter has a positive impact on pedagogy and enables users to maximize their knowledge, to become more involved in the learning processes and to have access to more stimulating contents Boufarouj, C. and Mdarbi, S. (2022, p. 379).

This leads us to the following sub-hypothesis:

***H1. 1:** ICTs appropriation have a significant and positive impact on the student's individual performance*

Vithal, K.S.R. (2013) conducted a study with the goal of investigating how engaging in educational performance activities impacts the productivity of individuals in an agricultural sciences institution. The findings indicated a clear and meaningful connection between educational performance and the publication output of faculty members. In simpler terms, the study revealed that when it comes to the performance of individual actors, higher educational performance directly translates into increased productivity Vithal, K.S.R. (2013, p. 240).

According to another study, educators identified various objectives for academic productivity, including progress in academia, providing support and motivation, gaining recognition, and contributing to the scientific community. The participants in the study viewed educational performance from a personal perspective, considering their individual goals. Huang and Hsu (2005) examined the relationship between educational performance and individual achievement and found that research students often competed to publish in renowned journals to enhance their reputation, gain a competitive edge, secure positions, or advance their careers cited in Karadağ, N. (2018, p. 10).

With regard to performance appraisal, Adaeze, O.C. (2019, p. 41) perceives this as the evaluation of an individual's performance, which is always measured in terms of such factors as job knowledge, quality and quantity of output, initiative, leadership abilities, supervision, reliability, cooperation, judgment, versatility, etc.

On the organizational level, a study was conducted to explore the connection between employee performance, productivity, and organizational performance within pharmaceutical companies in Nigeria. The findings by Joseph, N.C. and Chined, O.U. (2022, p. 114) revealed a positive correlation between motivation and organizational performance. The study highlighted that when employees are adequately motivated; their productivity increases, leading to significant improvements in organizational performance.

In conclusion, empirical evidence supports the notion of a positive relationship between individual performance and educational performance, which, therefore, backs the second sub-hypothesis:

H1.2: Individual student performance has a significant and positive impact on educational performance

This brings us to suggest the following main hypothesis, which focuses on the role of individual student performance as a mediator in the relationship between ICTE implementation and educational performance.

H1: Individual student performance mediates the relationship between ICTE appropriation and educational performance

A number of researchers, such as Ben Youssef A. and Dahmani M. (2010); Abdel-Ouahed A. (2014); Ko E.J. et al. (2021), etc., have attempted to summarize the main findings of the literature concerning ICT use, appropriation and student outcomes (educational performance).

Ben Youssef A. and Dahmani M. (2010, p. 14) state explicitly that ICT seems to have a profound impact on the learning process in higher education by offering new opportunities to learners. These opportunities can have an immediate effect on the students' performance and outcomes. Researchers argue that ICT requires a long process of appropriation by higher education institutions before significant change can be observed. However, the lack of organizational change in higher education is the main reason for this. The adoption of complementary organizational innovations is the key to the student's performance and results. Students acquire new capabilities and skills - more collaboration, teamwork, project management - that are more closely aligned with the needs of the job market.

In Abdel-Ouahed A.'s view (2014, p. 103), it's not enough to have resources to guarantee genuine appropriation by learners. It's useful to first help students develop their autonomy before giving them responsibility. Autonomy is built up by involving students, by making them feel secure, and by encouraging them to share, self-observe and self-assess. Autonomy, in fact, is "this disposition, this capacity to act independently, responsibly, to take charge of one's actions and learning in the fulfillment of one's needs". However, student motivation is an essential factor in the successful

integration and appropriation of ICTE. It is even at the heart of autonomy in learning. Thanks to motivation, learners change their attitudes towards the use of the technical object, and learn to receive and produce, because the technological tool can only foster a process of knowledge mediation if there is a double action in reception and production, and if the receiver has a favorable cognitive posture towards media.

According to the findings by Ko E.J. et al. (2021, p. 6), platform quality, task performance and a sense of self-determination were found to positively influence the appropriation of ICTs, which in turn will significantly influence the stakeholders' performance. This result suggests that platform quality is essential to promote the use of technology in the organization; it is therefore necessary to build a technology-friendly physical environment. However, the more individuals are empowered, the more appropriation unfolds.

To conclude based on empirical evidence, there is a notable association between students' adoption of ICT and their educational performance. As a result, the hypothesis is supported.

H2: Students' appropriation of ICT has a significant and positive impact on their educational performance

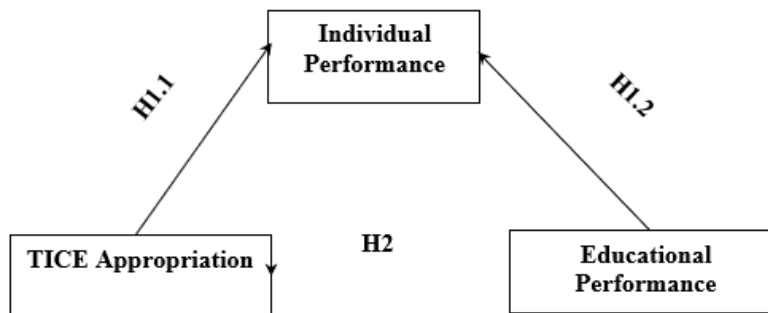


Figure1: Research Model
(Source: Authors)

Methods

Research methodology

In this section, we will move into the research methodology adopted in our study. We will explore various aspects, including the selection of the target population, our epistemological stance, the methodology chosen, and the sampling and data collection procedures implemented to effectively address our research question.

Population

Nowadays, educational systems have significantly ramped up their technological resources to resume normal activities. The integration of

technology in education has taken various forms such as distance learning, e-learning, hybrid learning, virtual education, and the traditional approach supported by technology. These advancements have had a substantial impact on educational performance.

The incorporation of Information and Communication Technology in Education (ICTE) plays a crucial role in creating a highly effective teaching and learning environment. It enhances the overall educational experience for students by improving the teaching and learning processes. Higher education administrators are actively involved in facilitating the integration of these new educational technologies across institutions through a continuous cycle of design, development, and advancement of functionalities.

In this context, appropriation refers to the conscious adoption and control of ideas, tools, technologies, and more, within the context of users' actual and perceived culture. The appropriation of ICTE encompasses the use of laptops, digital content, software, projectors, platforms, and the internet for educational purposes in the classroom, aiming to enhance teaching quality and educational performance across different educational settings.

Learning to effectively utilize ICT has different interpretations. Since the impact of ICT on student outcomes heavily relies on the consistency of its implementation, it becomes challenging to separate this type of learning from the inherent infrastructure of ICT as it pertains to academic achievements. The use and implementation of ICT in learning have demonstrated significant success in improving academic performance, especially in an increasingly globalized environment.

Considering the significance of the topic, our research focuses on university students. They serve as the key actors within our research context and are widely involved in pedagogical projects that emphasize student-centered learning approaches over traditional teacher-controlled methods.

Epistemological positioning

In order to ensure coherence between the research problem and the research context, it is widely acknowledged that the epistemological position, research approach, and choice of methods should align.

As far as our epistemological stance is concerned, we have adopted a positivist perspective for our study, as we seek to examine the growing significance of ICT appropriation in the educational performance of students in Moroccan public institutions. Positivism justifies the construction of a hypothetico-deductive system, which is subsequently tested against representative empirical situations. This approach involves formulating one or more hypotheses and comparing them with real-world observations. The

objective is to assess the validity of the initially proposed hypothesis. In other words, our analytical tools are derived from theoretical foundations.

We have employed a quantitative research approach for our study, utilizing structural equation modeling and software such as SPSS and SMART PLS. This approach allows us to examine causal relationships between variables and test our proposed hypotheses.

Measurement scales

To measure ICT appropriation, we used the 3 dimensions adopted by Pelletier C. et al. (2008). The instrument consists of 4 items, covering 3 dimensions of ICT appropriation, namely cognitive absorption, inspired by the "Flow Theory" presented by Csikszentmihalyi M. (1990), user skills, inspired by the model unveiled by Munro M.C. et al., (1997), and feelings of self-efficacy towards technology, inspired by the "Social Cognitive Theory" put forward by Bandura A. (1977).

To measure educational performance, we used the approach adopted by Charlot, Bautier, and Rochex, 1992. The instrument is made up of 3 items, covering a single dimension of educational performance, and consists in drawing up a balance sheet of knowledge and appreciation regarding the use of ICTE in connection with a job.

To measure individual performance, we used the 2 dimensions adopted by Koopmans L. et al. (2011). The instrument consists of 18 items.

Sampling and data collection

We conducted a questionnaire survey of students at public universities in the Casablanca-Settat region of Morocco. The survey covered all streams and cycles of the three universities in the region, namely: Hassan II University of Casablanca (UH2C), Chouaib Doukkali University of El Jadida (UCD), and Hassan I University of Settat (UH1). These universities comprise 32 establishments, with 193,509 students.

The region was chosen because of its involvement and progress in implementing information and communication technologies in education (ICTE). In this context, we collected 185 questionnaires, a sample comprising 46% men and 54% women, with an average age between 18 and 30.

The data collection method differed from one school to another, as each school had its contextual constraints. Indeed, the questionnaire was distributed via social networks, emails, etc. Students participated voluntarily in the contribution of this article. The "snowball" method was also used to distribute the questionnaire to reach a large number of students.

Results

The model is tested by the PLS-SEM (Part Least Squared Structural Equation Modeling) method, this choice is motivated in particular by the fact that this method does not require a standardized distribution of the data Chin (1998); Fornell et Cha (1994); Gefen et al. (2011); Ringle et al. (2012), and is considered the most suitable for moderate sample sizes Fernandes (2012).

A three-stage analytical procedure is followed using Smart PLS 4.0 software: evaluation of the psychometric specificities of the research model (measurement model), followed by hypothesis testing (structural model). Finally, the mediation analysis procedure was conducted to assess the mediating effect of individual performance in the relationship between ICTE appropriation and educational performance.

Assessment of measurement model

Factor loadings were assessed for each item (Table 1). All items met Fernandes' (2012) thresholds of 0.5, except for the five individual performance items, Perf_individ_14 (CF=0.378), Perf_individ_15 (CF=0.339) Perf_individ_16 (CF=0.191), Perf_individ_17 (CF=0.246) and Perf_individ_18 (CF=0.235); which we decided to eliminate.

From a statistical point of view, the reliability of the constructs is assessed by calculating Cronbach's alpha and the composite reliability index (CR). As shown in Table 1, these indices greatly exceed the acceptability threshold of 0.7 Fernandes (2012); George and Mallery, (2003). To assess convergent validity, we examine the average variance extracted (AVE) of the constructs, with all three values exceeding Fornell and Larcker's (1981) required thresholds of 0.5. (see Table 1)

Discriminant validity is also ensured, firstly according to the criterion of Fornell and Larcker (1981), which consists of verifying that the square root of the AVE for each construct exceeds the correlations between the constructs and their measurement items are greater than the cross-correlations (see Table 2).

The results of the cross-loadings (Table 3) allow us to ensure that all the items make a strong contribution to the variables to which they are attached, in comparison with the other variables.

Table 1: Loadings, Reliability, and Convergent Validity

Construct	Items	Loadings	Alpha	CR	AVE
ICTE appropriation	Approp_TICE_1	0,809	0,821	0,881	0,650
	Approp_TICE_2	0,820			
	Approp_TICE_3	0,778			
	Approp_TICE_4	0,817			

(Continued)

Table 1: Continued

Construct	Items	Loadings	Alpha	CR	AVE
Educational performance	Perf_educ_1	0,918	0,910	0,943	0,847
	Perf_educ_2	0,919			
	Perf_educ_3	0,924			
Individual performance	Perf_individ_1	0,734	0,942	0,950	0,593
	Perf_individ_2	0,805			
	Perf_individ_3	0,755			
	Perf_individ_4	0,823			
	Perf_individ_5	0,784			
	Perf_individ_6	0,773			
	Perf_individ_7	0,790			
	Perf_individ_8	0,801			
	Perf_individ_9	0,805			
	Perf_individ_10	0,750			
	Perf_individ_11	0,738			
	Perf_individ_12	0,753			
	Perf_individ_13	0,685			
	Perf_individ_14	0,378			
	Perf_individ_15	0,339			
	Perf_individ_16	0,191			
	Perf_individ_17	0,246			
	Perf_individ_18	0,235			

CR: Composite reliability, Alpha : Cronbach Alpha
(Source : Smart PLS 4.0)

Tableau 2: Discriminant validity (Fornell et Larcker, 1981)

	.(1)	.(2)	.(3)
ICTE appropriation (1)	0,806		
Educational performance (2)	0,669	0,920	
Individual performance (3)	0,772	0,716	0,770

The diagonal: the square roots of AVE

Table 3: Cross-loadings

Construct	Items	ICTE appropriation	Educational performance	Individual performance
ICTE appropriation	Approp_TICE_1	0,809	0,508	0,572
	Approp_TICE_2	0,820	0,489	0,611
	Approp_TICE_3	0,778	0,598	0,617
	Approp_TICE_4	0,817	0,553	0,679
Educational performance	Perf_educ_1	0,637	0,918	0,677
	Perf_educ_2	0,604	0,919	0,615
	Perf_educ_3	0,606	0,924	0,682
Individual performance	Perf_individ_1	0,559	0,575	0,734
	Perf_individ_2	0,645	0,582	0,805
	Perf_individ_3	0,550	0,565	0,755
	Perf_individ_4	0,728	0,696	0,823
	Perf_individ_5	0,518	0,585	0,784
	Perf_individ_6	0,569	0,518	0,773
	Perf_individ_7	0,601	0,547	0,790
	Perf_individ_8	0,574	0,526	0,801
	Perf_individ_9	0,596	0,535	0,805
	Perf_individ_10	0,597	0,500	0,750
	Perf_individ_11	0,493	0,457	0,738
	Perf_individ_12	0,554	0,476	0,753
	Perf_individ_13	0,673	0,546	0,685

(Source: Smart PLS 4.0)

With the psychometric specificities required for our model assured, we next examine the structure.

Assessment of structural model

During this stage, we have evaluated the structural fit of our model by initially examining the level of variance explained by the endogenous constructs, utilizing the R2 index. Subsequently, considering the validity of the research hypotheses, we assess each correlation coefficient associated with them. This assessment involves considering the value of the standardized beta coefficient (close to 0 indicating a weak link, and close to 1 indicating a strong link), the direction of the effect (positive or negative), the significance level (typically set at 1.96), as well as the probability of error (the p-value).

Table 4 and Figure 2 summarize the results of our overall research model, wherein all the hypotheses are corroborated.

Table 4: Hypothesis testing

Hypothesis	Beta	T statistics	P values	Validation
Approp_TICE -> Perf_educ	0,289	2,829	0,005	YES
Approp_TICE -> Perf_individ	0,772	20,898	0,000	YES
Perf_individ -> Perf_educ	0,493	5,243	0,000	YES

(Source: Smart PLS 4.0)

We then proceed to analyze the mediation.

Mediation analysis

A mediation analysis was performed to assess the mediating role of individual performance on the relationship between ICTE appropriation and educational performance. The results (Tables 5 and 6) reveal that the total effect between ICTE appropriation and educational performance is significant and positive (beta=0.669, t=13.209, p=0.000).

In the presence of the educational performance variable, the direct effect of ICTE appropriation on educational performance is always significant and positive (beta=0.289, t=2.829, p=0.005). As for the indirect effect of ICTE appropriation on educational performance via individual performance, it is significant and positive (beta=0.381, t=5.027, p=0.000).

Based on these findings, we have found support for the hypothesis proposing the presence of a mediating effect of individual performance in the connection between ICTE adoption and educational performance. However, it is important to note that this mediation effect is partial rather than complete.

Table 5: Total and indirect effects

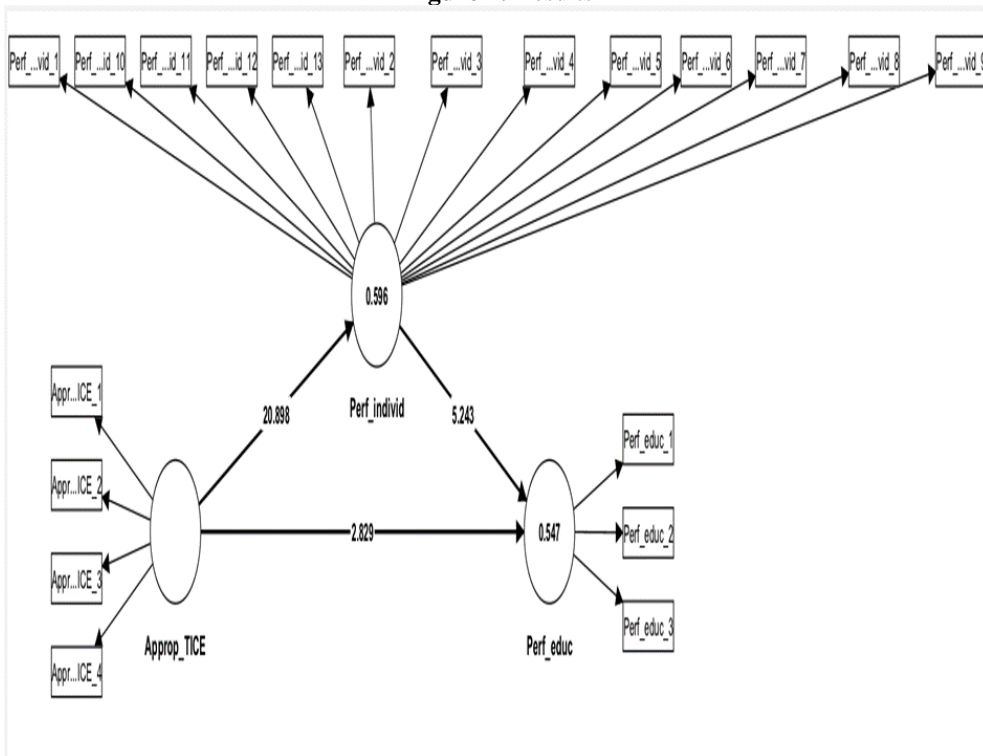
	Total effect		Direct effect	
	beta	P values	beta	P values
Approp_TICE -> Perf_educ	0,669	0,000	0,289	0,005

(Source: Smart PLS 4.0)

Table 6: Direct effect

	beta	moyenne	Ecart type	T statistics (O/STDEV)	P value
Approp_TICE -> Perf_individ					
Perf_educ	0,381	0,381	0,076	5,027	0,000

(Source: Smart PLS 4.0)

Figure 2: Results

R^2 (individual performance) = 0,596 ; R^2 (educational performance) = 0,547
(Source : Smart PLS 4.0)

Discussion

The primary objective of this study is to address the following research query: How does individual performance affect the correlation between ICTE appropriation and educational performance? The contributions of this study are twofold.

Firstly, an extensive evaluation has been conducted to validate the tools suggested by Pelletier C. et al. (2008) for measuring ICTE appropriation, those proposed by Charlot, Bautier, and Rochex (1992) for measuring educational performance, and those put forth by Koopmans L. et al. (2011) for measuring individual performance. This assessment has focused on determining their explanatory capabilities.

Secondly, a validation of measurement tools enables the integration of individual performance, to account for the nature of the impact of ICTE appropriation on educational performance. The results demonstrate the validity and convergence of the models adopted in this research.

In our analysis of the reliability and validity of different measurement scales, we found that 5 items did not provide sufficient explanation based on statistical results, which fell short of the required 0.5 threshold. Consequently, these items were removed. We want to emphasize that the

research model has been successfully validated. Specifically, for public higher education students in the Casablanca-Settat region, we have applied the ICTE appropriation concept from Pelletier et al. (2008), the educational performance concept from Charlot, Bautier, and Rochex (1992), and the individual performance concept from Koopmans et al. (2011).

The second aim of this study was to examine the role of individual performance in the connection between ICTE appropriation and educational performance. The findings indicate that individual performance serves as a mediating factor between ICTE appropriation and educational performance.

The Results revealed two significant and positive relationships. Firstly, there was a significant and positive association between ICTE appropriation and educational performance ($\beta=0.289$, $t=2.829$, $p=0.005$). Secondly, a significant and positive relationship was confirmed between ICTE appropriation and individual performance ($\beta=0.381$, $t=5.027$, $p=0.000$). These results demonstrate that student engagement with ICTE plays a substantial role in explaining the educational performance of public higher education institutions in the Casablanca-Settat region. Additionally, the individual performance of students in utilizing ICTE contributes to enhancing educational performance within the university setting.

Numerous authors, including DeLone and McLean (1992, 2003) and Barragán Giraldo and Amador Báquiro (2020), emphasize that the adoption of ICTE empowers students to engage more interactively and actively in its utilization, resulting in a positive impact on their educational performance. This increased involvement motivates students to embrace the use of ICTE, leading to improvements in their skills and overall performance.

Similarly, various studies highlight the significance of individual performance in attaining higher levels of educational achievement through ICTE utilization. Researchers such as Saint-Onge and Magnan (2007), Sonnentag and Frese (2002), Aicha Abdel-Ouahed (2014), A. Ben Youssef and M. Dahmani (2010), El Hadri et al. (2022), and Z. Atitallah (2022) have all underscored the importance of individual performance in leveraging the full potential of ICTE for educational purposes.

The examination of sub-hypotheses confirms the significant and positive impact of ICTE appropriation on individual performance, as sub-hypothesis (H1.1) is accepted. Furthermore, it is affirmed that individual performance significantly and positively influences educational performance, as sub-hypothesis (H1.2) is accepted. These findings align with previous research, including the study conducted by Vithal (2013), which establishes a positive and significant relationship between academic performance and publication productivity among school members. Moreover, Barragán Giraldo and Amador Báquiro (2020) emphasize the importance of ICT appropriation for pedagogical innovation and the development of users'

skills, while Boufarouj and Mdarbi (2022) suggest that ICT appropriation enables users to maximize their knowledge. In summary, it can be concluded that individual performance acts as a mediator in the relationship between students' adoption of ICTE and their educational performance, thus confirming hypothesis (H1).

The confirmation of the second hypothesis (H2) establishes a significant and positive relationship between ICTE appropriation and educational performance. Building upon existing literature, Ben Youssef and Dahmani (2010, p. 14) highlight that ICT has a profound influence on the learning process in higher education, presenting learners with new opportunities. Additionally, other authors, like Ko et al. (2021), assert that factors such as platform quality, task performance, and a sense of self-determination positively contribute to ICTE appropriation, subsequently impacting the performance of individuals involved.

For a comprehensive overview of our study's findings, please refer to the table below:

Table 7: Summary of Results Achieved

Main and sub-hypotheses	Final Decision
H1 : Individual student performance mediates the relationship between ICT appropriation and educational performance	Approved
H1.1 : ICT appropriation significantly and positively impacts individual student performance	Approved
H1.2 : Individual student performance has a significant and positive impact on educational performance	Approved
H2 : Students' appropriation of ICT has a significant and positive impact on educational performance	Approved

(Source: Authors)

Conclusion

This article aims to provide a concise overview of key insights derived from an extensive literature review encompassing theoretical and empirical studies on the effective utilization of information and communication technology (ICT), the integration of ICT in education (ICTE), educational performance, and individual performance among university students. The findings strongly indicate that ICT has a profound influence on the learning process within higher education, presenting fresh opportunities for learners. These possibilities are evidently contributing to improvements in student performance and accomplishments. The outcomes of this investigation validate the existence of a direct correlation between the adoption of ICT and educational performance, with individual performance acting as an intermediary factor in this relationship.

Over the past two decades, a substantial body of literature has extensively examined the direct relationship between the use of information

and communication technology (ICT) and student performance. Numerous studies have aimed to elucidate the role and added value of these technologies in the classroom and their impact on student outcomes. Initially, the focus was on investigating the influence of computer usage. However, with the advent of the Internet revolution, scholarly attention has shifted towards exploring the effects of online pedagogical activities, such as internet utilization, engagement with online platforms, and distance learning. On one hand, some authors argue that there is insufficient evidence to support the role of ICT in higher education Kirkpatrick and Cuban (1998); Angrist and Lavy, (2002); Banerjee et al. (2004). On the other hand, several studies assert a substantial impact of ICT on student performance Kulik (1999); Sosin et al. (2004); Talley (2005).

Based on our findings, it is crucial to highlight the significance of the individual when assessing educational performance. While the adoption of organizational innovations within higher education plays a significant role in students' academic achievements, it is essential to recognize the evolving performance of students who actively engage with and utilize ICTE. These students are developing new skills and competencies, particularly in areas such as collaboration, teamwork, and acquiring knowledge that aligns closely with the demands and realities of the job market.

Considering this, future research endeavors should focus on examining the individual performance of Moroccan university students and its impact on their educational outcomes. Such investigations have the potential to enhance the Moroccan higher education system and better cater to the learning needs of university students, ensuring they are adequately prepared for their future careers.

Acknowledgement

We would like to express our deep gratitude to all the researchers for their valuable contribution to the realization of this scientific article. This work was made possible thanks to funding from the National Center for Scientific and Technical Research (CNRST) as part of a project accepted by this organization. We would also like to express our gratitude to Mr. Lhoussain Simour: A Research Professor at "École Supérieure de Technologie" in Casablanca, who devoted time and energy to translating our article into English. This translation is crucial to allow our research to reach an international audience and have a wider impact. The commitment, expertise and dedication of all researchers have been essential to carry out high quality research and produce an article that will contribute significantly to the understanding of our field of study.

Authors' contributions

All the researchers namely: "S. MDARBI, L. SIMOUR, C. BOUFAROUJ, Z. BELKEBIR, K. STILI, M. ENNADI" contributed to conceptualizing the study, writing and revising the manuscript. L. SIMOUR, translated the article into English, revised the manuscript. C. BOUFAROUJ, Z. BELKEBIR, K. STILI, M. ENNADI: developed the questionnaire, collected the data, carried out the data analysis.

Conflict of Interest: The authors reported no conflict of interest.

Funding Statement: This research received a specific grant from a public organism named: National Center for Scientific and Technical Research (CNRST).

Availability of data and materials: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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