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The Impact of a Blended Learning Model on Undergraduate University Students' Digital Literacy Skills: Empirical Evidence from Higher Education

Mohammed El Messaoudi

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Author for correspondence:
Mohammed El Messaoudi
m.elmessaoudi@umi.ac.ma
Faculty of Art and Humanities, UMI, Meknes, Morocco.

Abstract

Background/purpose. Morocco's recent higher education reform, Pacte ESRI-2030, lays emphasis on digital skills, a major component of Power Skills, as a catalyst for student success. Pursuant to this, the current study aimed at assessing the effectiveness of a blended learning model in improving undergraduate students' digital literacy skills.

Materials/methods. A quasi-experimental design was deployed to investigate the impact of a blended learning intervention on the digital skills of 15 S5 Educational Linguistics students. Participants were administered a pre-DSAT and a hybrid learning experience combining in-class instruction and an online SPOC. A post-DSAT was then allocated to measure learning outcomes.

Results. The paired-sample t-test revealed a significant increase in DSAT scores ($p = .035$) from the pre-test ($M = 206.67$) to the post-test ($M = 258.10$), indicating improved digital skills. Cohen's d of 0.79 suggests a large effect size. Participants maintained high performance on the final exam, suggesting sustained learning.

Conclusion. The blended learning model effectively improved the participants' digital literacy skills. These results contribute to the growing evidence supporting the efficacy of blended learning in developing key digital skills.

1. Introduction

Gilster's 1990s definition of "digital literacy" was fundamentally linked to education. The author placed ample emphasis on the internet's transformative potential and defined digitally literate individuals as those proficient in handling online text and multimedia within formal learning settings (Gilster & Glister, 1997). Such an early understanding of digital literacy foreshadowed the profound impact of Information and Communications Technology (ICT) on learning, both in educational institutions and the home, where ICT has become an indispensable tool for knowledge acquisition and skill development (Meyers et al., 2013). In accordance, the internet has unlocked a vast and virtually limitless supply of information. Consequently, modern learning processes now heavily call attention to the digital skills needed to find, retrieve, assess, organize, and effectively communicate information from digital sources (Pagani et al., 2016). In like manner, Meyers et al. (2013) state that new technologies and media are changing the shape of communication, learning, work, and even how we govern ourselves. They insist that in order to adapt to this environment, individuals need both technical skills and a profound understanding of digital ethics and responsible use. The authors conclude that digital literacy involves handling issues like online safety, evaluating information sources, and using media creatively and ethically. More recent studies go further and warn that those who lack these skills will face significant constraints in their ability to succeed as students, employees, and engaged members of society (Itu & Amer, 2024; Kappeler, 2024; Stofkova et al., 2022; Vitezić & Perić, 2024). With reference to the study context, Moroccan higher education, Moroccan undergraduate university students, as future employees and employers, are compelled to possess a robust digital skillset to excel in their studies and future careers (Elhazziti et al., 2023; Errihani, 2024; Morocco). Incontestably, traditional learning methods play a crucial role in higher education. Incorporating innovative approaches like blended learning would substantially boost digital skill development (Alsalhi et al., 2021; Balula et al., 2019; Bykova et al., 2021). One promising approach to digital skills development is blended learning (Graham, 2018; López-Pérez et al., 2011; Muxtorjonovna, 2020; O'Connor et al., 2011; Patmanthara & Hidayat, 2018). Blended learning (Figure 1) combines face-to-face instruction with online learning, and it can be used to deliver digital skills training in a flexible and engaging way.

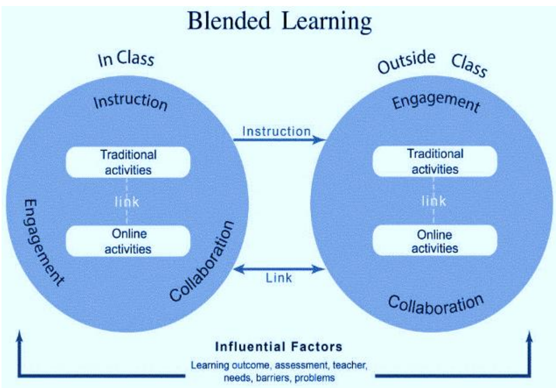

Figure 1. The Concept of Blended Learning

Combining various learning methods (face-to-face, online) creates optimal training programs (Bersin, 2004; Hofmann et al., 2006). Based on solid empirical evidence, it was reported that blended learning upgrades active learning, skill mastery, and learner engagement (Akbarov et al., 2018; Alsalhi et al., 2021; Bykova et al., 2021; Dakhi et al., 2020; Hofmann et al., 2006; Stepanova, 2020).

1. 1. Research Questions

This study investigates the efficacy of a blended learning intervention in improving the digital literacy skills of undergraduate students. Specifically, it aimed to assess whether a blended learning approach would improve the digital skills of (S5) undergraduate students enrolled in the Bachelor of Excellence Stream (Educational Linguistics) at the Faculty of Arts and Humanities, Moulay Ismail University, Morocco. The research question guiding this empirical study was:

1) Do Moroccan S5 undergraduate students in Educational Linguistics experience significant improvement in their digital skills over time through a blended learning model?

1. 2. The Significance of the Study

The digital environment comprises all aspects of life and work. Developing strong digital skills has been proven crucial for academic success and career preparedness in higher education (Goulart et al., 2022; Heeks, 2017; Itu & Amer, 2024; Jackman et al., 2021). This study specifically addressed the need to improve digital skills among students enrolled in specialized programs like the Bachelor of Excellence Stream. Through investigating the effectiveness of a blended learning approach in that context, the research sought to contribute to the existing body of knowledge on effective pedagogical strategies widely deployed to incorporate digital skills into higher education curricula, particularly within language-related programs.

2. Literature Review

The concept of "digital literacy" has garnered significant attention in recent years (e.g., Helsper & Van Deursen, 2015). Nonetheless, its precise definition remains elusive, partly due to its relatively recent emergence. Even before the widespread adoption of technologies like Google, Facebook, and YouTube, early attempts to understand digital literacy practices were made (Gilster & Gilster, 1997), focusing on skills such as online research, social networking, and e-learning—activities now integral to daily life. Helsper and Van Deursen (2015) emphasize the wide range of abilities involved in effectively utilizing information and communication technologies (ICTs). Recognizing the need for a clear conceptualization, major international organizations such as UNESCO and the UN have invested substantial resources in defining and promoting digital literacy across the globe. Distinctly, the UNESCO Institute for Statistics (UIS) has proposed a comprehensive definition: "the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship" (UIS, 2021). This definition underscores the multidimensional nature of digital literacy, which accentuates its application across diverse domains, including communication, information management, and professional development. Similarly, the International Telecommunication Union (ITU), responsible for globally measuring ICT adoption, defines digital skills in terms of their positive outcomes: "the ability to use ICTs in ways that help individuals to achieve beneficial, high-quality outcomes in everyday life for themselves and others" whereas also mitigating potential harms associated with digital engagement (ITU, 2018, p. 23). As stated, these varying definitions showcase the complex and changing nature of digital literacy and have significant implications for research, policy, and practice. Namely, the emphasis on "safe and appropriate" use (UIS, 2021) necessitates research into online safety and responsible digital citizenship. For that reason, there is a renewed interest in digital skills beneficial outcomes that would inform policy initiatives, help bridge the digital divide and promote digital inclusion (Bakkali et al., 2024; Belkhatab & Haddouche, 2024; Kappeler, 2024; Livingstone et al., 2023; Mostova, 2024; Stefanović et al., 2024; Van Deursen & Van Dijk, 2014).

The specific aspect of digital literacy addressed in the current study is the development of pedagogical digital skills within a blended learning environment in higher education. The focus is not just on the technical skills of using ICTs, but specifically on the ability of students to integrate educational technology effectively into teaching and curriculum development. Existing research on digital literacy in higher education has primarily focused on access to technology and basic digital skills (Bailey, 2023; Elhazziti et al., 2023). Still, a gap remains in our understanding of how blended learning models specifically impact the development of pedagogical digital skills required for effective language teaching and curriculum design. In response, the current study ventured to assess the effectiveness (impact) of a blended learning model in developing these pedagogical digital skills among students enrolled in an Educational Linguistics program.

2. 1. Global Digitalization, Youth, and Educational Needs

Several studies have confirmed that young people are naturally interested in learning digital technologies (Bell et al., 2015; Coleman, 2015; Davies et al., 2015; Haddon et al., 2020; Selwyn, 2015). A recent systematic review by Haddon et al. (2020) investigated factors that influence and result from digital skills in adolescents (12-17 years old). This age group was widely chosen due to its centrality in developing digital skills curricula (Bulganina et al., 2021; Eynon & Geniets, 2016; Haddon et al., 2020; Helsper & Van Deursen, 2015; Jackman et al., 2021; Miller & Bartlett, 2012; van Kessel et al., 2022) and informing future longitudinal studies on European children's digital skill development (Haddon et al., 2020). Previous studies have also reported that the emergence of informal 'casual learning' through online communities stresses how digital skills transform our approach to knowledge, individual agency, social interaction, and flexibility (Meyers et al., 2013). Likewise, these skills are seen as key to their future careers, seeing many cogitate the "jobs of the future" that will require them (Canton, 2021; Mihai et al., 2022; OECD., 2018; van der Vlies, 2020).

Broadly, digital education is supposed to equip citizens with the ability to use digital technologies effectively and responsibly (Jackman et al., 2021; Livingstone et al., 2023). Research confirms the link between digital skills and positive outcomes like employability, consumer adoption of technology, and accessing trustworthy information (Livingstone et al., 2023). Nevertheless, concerns exist about potential risks associated with online activities and point to the ascendency of digital skill development (Cushing & Osti, 2023; Eynon & Geniets, 2016; Ferrari, 2012; Goulart et al., 2022).

2. 2. Digital Skills Training in the Moroccan Context

The Moroccan higher education sector aims at integrating ICT into teaching and learning to improve student performance and prepare them for the digital economy. It has been reported that successful digital skills development requires more than just infrastructure and resources; it necessitates realizing the pedagogical affordances of ICT (Chergui et al., 2020). Thus, digitalization has become a national priority for Morocco's socioeconomic development (Bourray, 2023). Notwithstanding, Moroccan universities face longstanding challenges in delivering quality education and preparing students for the modern workplace (Benjelloun, 2022; Errihani, 2024). To address these challenges, a recent reform introduced specialized tracks such as Educational Linguistics (Meknes Moulay Ismail University report, 2023). Unlike the traditional three-year Licence, this intensive, career-oriented program provides graduates with expertise in language teaching, curriculum development, and educational technology integration.

3. Methodology

3. 1. Research Design (Quasi-experimental, pre-test/post-test design)

The methodology employed in this study utilizes a quasi-experimental pre-test/post-test design. This design was chosen due to its practicality and ethical considerations within real-world educational settings, particularly relevant when working with existing classroom structures and avoiding disruption (Chih-Pei & Chang, 2017; Clark & Creswell, 2008; Creswell & Creswell, 2005, 2017). Random assignment of participants, often ideal in experimental designs, was deemed infeasible due to practical constraints within the context of the existing educational program (Gross et al., 2006; Koog & Min, 2009; Metcalf & Thornton, 1992; Ong-Dean et al., 2011; Sidani, 2006). This quasi-experimental approach allows for the assessment of the intervention impact within the existing classroom context, thereby improving the generalizability of the results to similar educational programs and settings (Craig & Hannum, 2007; Shadish & Luellen, 2012; Thyer, 2012; White &

Sabarwal, 2014). On top of that, the pre-test/post-test design provides resource efficiency, particularly valuable in smaller-scale studies, by focusing on individual improvement measured through pre- and post-intervention comparisons (Dugard & Todman, 1995). Even though the absence of a control group limits the ability to definitively attribute changes solely to the intervention, the pre-test data provides a robust baseline for analyzing individual progress and mitigating the influence of external factors on the intervention effectiveness (Campbell & Riecken, 1968). Statistical analysis employed paired samples t-tests to compare pre-and post-test scores. Given the nature of the data and research questions, these tests were chosen for appropriateness.

3.2. Data Collection

In this study, the Digital Skills Assessment Tool (DSAT)—a reliable and valid instrument developed by the European Union— was employed to evaluate the effectiveness of the intervention. The DSAT was administered at two critical time points: pre-test before the intervention commenced and post-test after the one-semester intervention ended (Fall 20232-2024). A consistent measurement of digital skills throughout the study period was geared towards accurately assessing both individual and group-level improvements resulting from the blended learning intervention. The aforementioned approach was deployed to ascertain a robust assessment of the impact of the intervention on the participants' digital skills development.

3. 3. Participants, Sampling, and Setting

This quasi-experimental study adopted a case study approach and involved a specific group of S5 undergraduate students (n=15) enrolled in the Bachelor of Excellence Stream at the Department of English Studies and Culture, UMI. The participants were not randomly selected but rather chosen as an intact sample. The sample size (See Table 1), being relatively small, is appropriate for a case study design and reflects the practical constraints of conducting research within a specific program and timeframe (one semester, Fall 2023-2024). With reference to the study participants' demographics (Table 1), there are more females (60.0%) than males (40.0%).

Table 1. Participants' Gender

		Frequency	Percent	Valid Percent
Valid	Female	9	60.0	60.0
	Male	6	40.0	40.0
	Total	15	100.0	100.0

Figure 2 shows that the most common age category (combined) ranges from 20 to 22, making up 47.3% of the sample. Notably, the age distribution is relatively diverse, with no other age group dominating significantly.

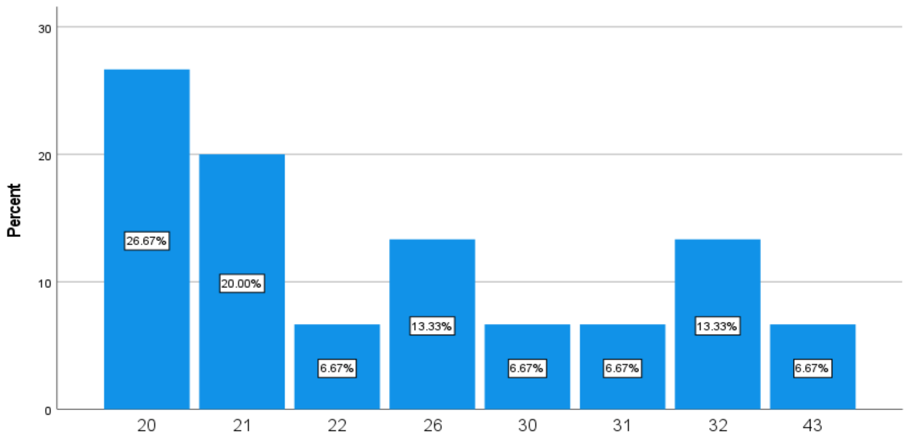

Figure 2. Participants' Age

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This indicates a predominance of millennials, also known as Gen Y, in the sample group. The age distribution is also described as relatively diverse, implying that other age groups are represented, but none are as numerous as the 20–22-year-olds.

3. 3. 1. The conceptual model

The study utilizes a quasi-experimental design. Figure 3 presents a conceptual framework that visually depicts this design. The framework illustrates the relationship between the independent variable (blended learning model), the dependent variable (digital skills development), and any potential control variables that might influence the outcome. (Figure 3).

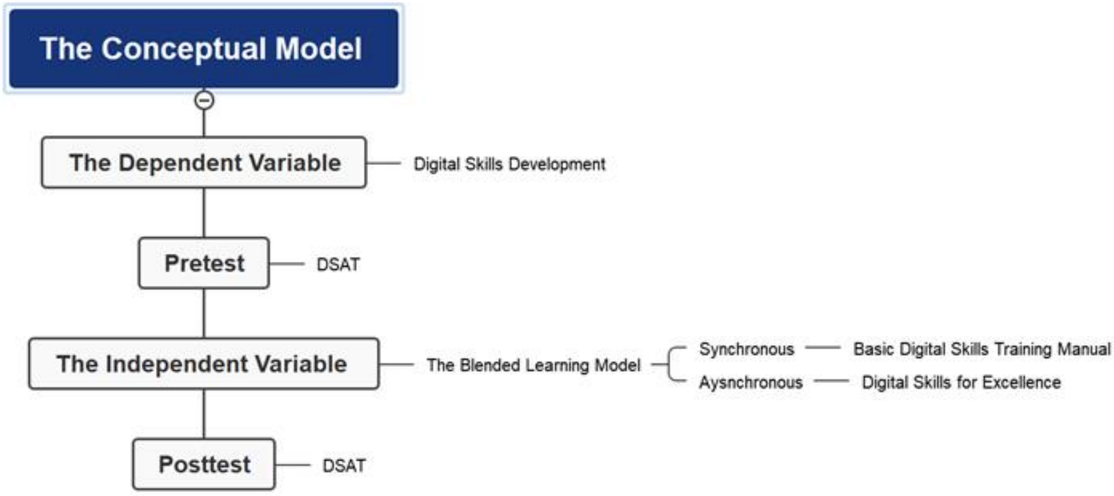

Figure 3. The Study Conceptual Model

As illustrated above, the study utilized a quasi-experimental design with a blended learning model as the independent variable. This model combined in-class sessions based on the British Council's Basic Digital Skills Training Manual with an out-of-class course delivered through Google Classroom using the DSAT platform (Digital Skills Assessment Tool). The effectiveness of this intervention was measured by its impact on the development of digital skills, which served as the dependent variable. The DSAT was used to assess participants' digital skills both before and after the blended learning program to determine the intervention impact (cause-effect).

3. 3. 2. The pretest

On October 18, 2023, the Digital Skills Assessment Tool (DSAT) was administered as a pre-test to participants at the Faculty of Art and Human Sciences, University Moulay Ismail (UMI) in Meknes, Morocco. This pre-test aimed at establishing a baseline of digital skills proficiency for evaluating the effectiveness of a subsequent training program. The DSAT provides a reliable and valid measurement backed by extensive research and piloting across Europe to align with real-world digital demands. Its standardized approach guarantees consistency and comparability across diverse populations. The DSAT utilizes various evaluation methods, including multiple-choice, closed-ended, and open-ended questions, to comprehensively assess the understanding and application of digital skills. Specifically, the pre-test focused on participants' ability to:

a) Find, access, and navigate different types of digital content (files, websites, etc.).

b) Compare information sources and discern their reliability.

c) Manage and organize folders and various types of digital files.

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3. 3. 3. The operationalization of the digital skills development BL program

This hybrid intervention (Figure 4) sought to arm undergraduate students with key digital literacy skills through a combination of a structured textbook and an interactive online course (a SPOC, a small private online course).

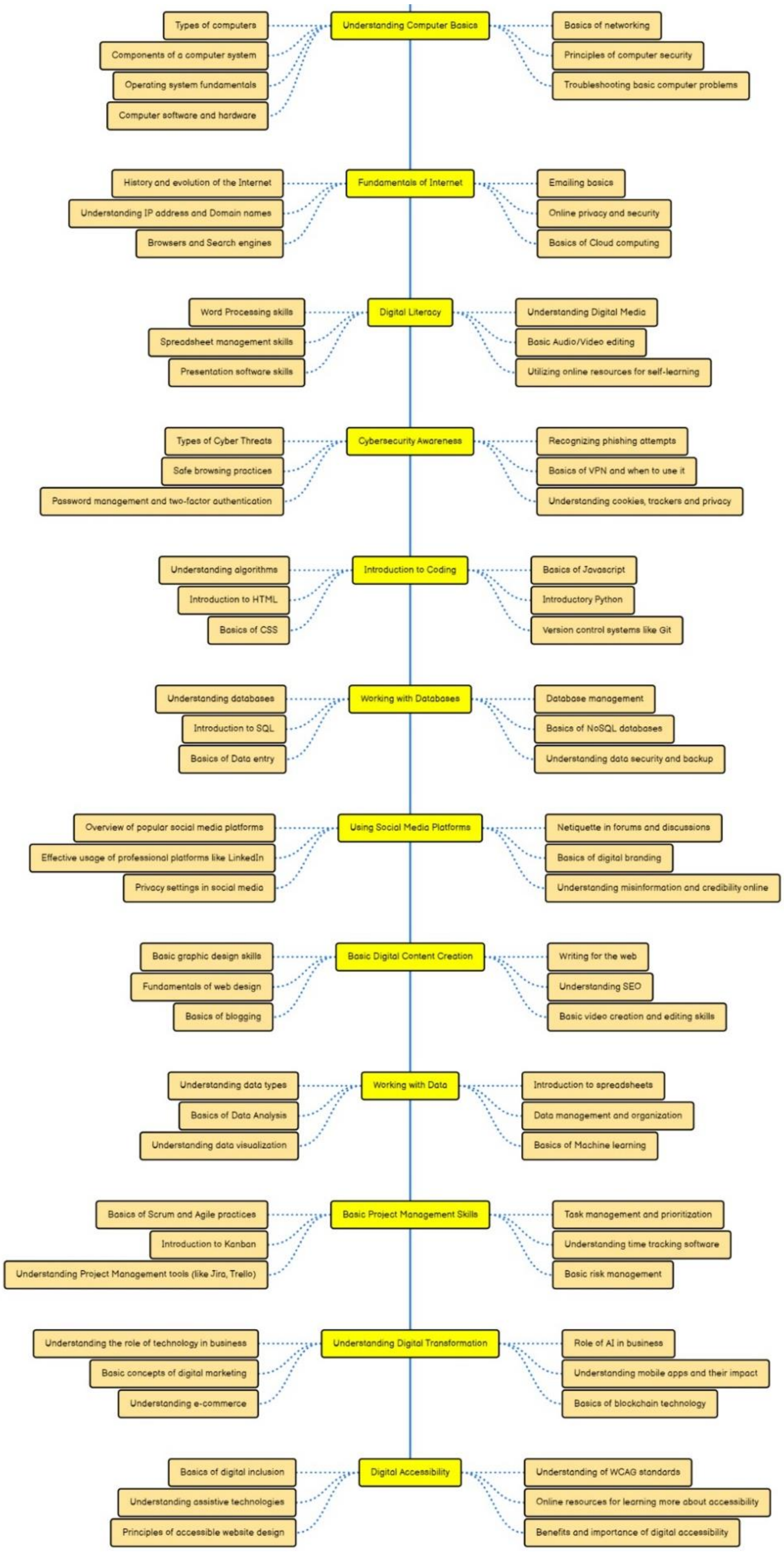

Figure 4. The Operationalisation of the Digital Skills BL Course

a) The Textbook "Skills for Inclusive Digital Participation" by the British Council

This manual provides step-by-step instructions and practical exercises covering core areas like using devices, navigating the internet, online communication, and productivity tools. The manual provides clear explanations, hands-on learning, and an inclusive approach for diverse learners.

b) Online Course: Self-paced Open Course (SPOC) on Google Classroom

Divided into three units, the SPOC covers the impact of technology on daily life, digital skills in various industries, and ways to foster a growth mindset for continuous learning. The asynchronous course proposes active learning activities grounded in industry expertise from FutureLearn Accenture and a focus on developing a positive learning attitude.

As depicted in Figure 4, the blended digital literacy course was operationalized through a series of key learning modules. These modules built upon each other, which promoted a foundational understanding of digital literacy among the participants. To expound, the course begins with understanding computer basics. This includes familiarizing learners with different computer types, operating system navigation, and basic troubleshooting techniques. Next, the course tackles cybersecurity awareness. This module covers various digital threats, password management strategies, and online privacy practices. Following that, learners' attention is diverted to digital content creation. This section explores the use of visual media platforms, multimedia integration in texts, and effective web writing. Finally, the course concludes with an understanding of digital data. Here, participants learn how to work with spreadsheets and develop essential data management skills.

3. 3. 4. The posttest

Using the same assessment tool (DSAT) for both pre-and post-testing safeguarded a high level of consistency and accuracy in measuring participants' development of digital skills. The chances of discrepancies that could arise from using different tests or materials were reduced due to this careful alignment, which permitted a more accurate assessment of the actual impact of the intervention on the treatment group's understanding of the topics covered (Figure 4).

3. 4. Data Analysis

The study employed a two-pronged approach to statistical data analysis using SPSS 27 software. Descriptive statistics were first generated to provide a comprehensive overview of the data distribution. The former process helps characterize the participants' baseline digital skill levels and track any changes after the intervention. For inferential analysis, a paired-sample t-test was used to analyze the quantitative data obtained from the pre-and post-DSAT assessments. This parametric test specifically compares the scores of individual students on the same test administered both before and after the intervention. The test in question helped the researcher effectively measure individual improvements in overall digital skills and potentially in specific skill areas identified by the DSAT.

4. Results

Table 2 shows the descriptive statistics for the participants' DSAT scores on both the pre-test and post-test. The mean score on the pre-test was 211.33 (SD = 56.29). In contrast, the mean score on the post-test was 256.67 (SD = 58.63). This indicates an average score of 45.33 points increase from the pre-test to the post-test.

Table 2. *Descriptives of the Participants' DAST Pre-test and Post-test Mean Scores*

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	DSAT_Pretest_Score	211.33	15	56.299	14.536
	DSAT_Posttest_Score	256.67	15	58.635	15.140

To determine if the observed improvement in digital skills was statistically significant, a repeated-measures t-test was conducted. This test is appropriate when comparing scores from the same participants before and after an intervention. Before the analysis, data normality and homogeneity of variance were assessed to confirm the validity of the t-test. Normality was evaluated using a histogram (Figure 5), which visually confirmed a symmetrical distribution, suggesting normality. The repeated-measures t-test compared the mean scores of the control group before and after the intervention (Table 3). The process helps determine if the observed difference in pre-and post-test scores is statistically significant, meaning it is unlikely due to chance.

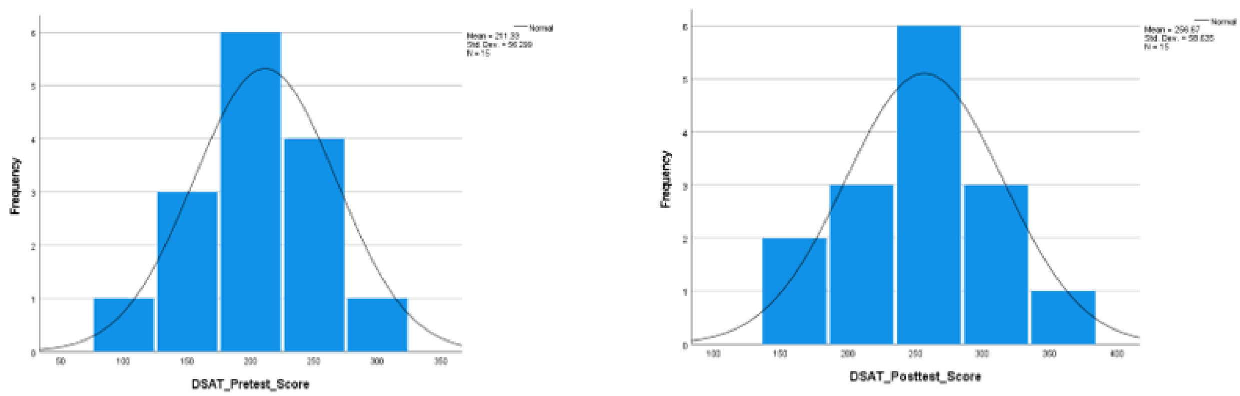

Figure 5. Data Normality (Pretest & Posttest)

With respect to homogeneity of variance, Table 3 represents the significance level (p-value) associated with the test statistic (Shapiro-Wilk) of the DSAT <u>pretest</u> (seeing the sample is less than 50). In this case, the p-value is .778, indicating no significant departure from normality at the conventional significance level. In turn, Table 4 represents the significance level (p-value) associated with the test statistic (Shapiro-Wilk) of the DSAT <u>post-test</u>. The p-value is .790, indicating no significant departure from normality at the conventional significance level.

Table 3. Homogeneity of Variance (the DSAT Pretest)

Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
DSAT_Pretest_Score	.176	15	.200*	.965	15	.778

Table 4. Homogeneity of Variance (the DSAT Posttest)

Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
DSAT_Posttest_Score	.123	15	.200*	.966	15	.790

The data satisfied the key assumptions for a paired-sample t-test, including normality and homogeneity of variance. These assumptions were verified through visual inspection of graphical representations (histograms) and by consulting relevant statistical tables (as shown previously). With these assumptions met, a repeated-measures t-test was conducted to analyze the paired data from the pre-and post-DSAT assessments.

Table 5. Repeated Measures T-Test of The Participants' Pre-Test and Post-Test Mean Scores

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	DSAT_Posttest_Score DSAT_Pretest_Score	45.333	75.391	19.466	3.583	87.084	2.329	14	.035

Table 5 presents the results of a paired-sample t-test comparing the pre-test and post-test scores. The results reveal a statistically significant difference between the two scores (t(df) = 2.329, p = 0.035). Since the p-value is less than 0.05, we can reject the null hypothesis, which states that there would be no difference in digital skills before and after the intervention. To assess the magnitude of this improvement, Cohen's d-effect size was calculated (Table 6). This statistic, which divides the mean score difference by the standard deviation, indicates a large effect size of 0.789. Following Cohen's (1992) criteria, a value of 0.2 suggests a small effect, 0.5 a moderate effect, and 0.8 a large effect. Therefore, the results demonstrate a substantial improvement in digital skills following the blended learning program.

Table 6. Effect Size

Paired Samples Effect Sizes

			Standardize	Point Estimate	95% Confidence Interval Lower	Upper
Pair 1	DSAT_Posttest_Score-DSAT_Pretest_Score	Cohen's d	57.483	.789	-.005	1.582
		Hedges' correction	59.082	.767	-.005	1.539

The table above shows a statistically significant improvement in participants' digital skills scores following the intervention. The average score increase was 0.789 standard deviations, which is considered a large effect size. This suggests that the blended learning program had a substantial positive impact on developing participants' digital skills. Markedly, based on the results of the paired-sample t-test, we can conclude that the blended learning intervention was effective in significantly improving the digital skills of the participants. Grounded on Table 7, we can observe that participants' digital skills improved significantly from the pretest to the posttest. The DSFES score, which represents the final exam performance, is notably higher, indicating substantial progress in digital skills by the end of the course.

Table 7. Descriptive Statistics of Within-Subject Factor Levels

Dependent Variables	Mean	Std. Deviation	N	Min	Max
DSAT_Pretest_Score	206.67	67.436	15	100	320
DSAT_Posttest_Score	258.10	74.125	15	160	380
D_S_F_E_S	364.86	1.660	15	362	367

It is imperative to note that participants, on average, showed significant improvement from the pretest (206.67) to the posttest (258.10) and performed well on the final exam (364.86), indicating that the blended learning model likely had a positive impact on their digital skills. The relatively high standard deviation for both pretest and posttest scores suggest considerable variability in individual performance within the group. The consistency in final exam scores indicates that participants' performance was consistent on the final assessment, which might suggest that the learning outcomes were well-established by the end of the course. Largely, the significant improvement from the pre-test to the post-test, coupled with the strong final exam performance, provides evidence for the effectiveness of the blended learning approach in improving participants' digital skill development.

5. Discussion

This study implemented a digital skills development intervention in a Moroccan open-access tertiary institution. The intervention combined a structured training manual called "Basic Digital Skills Training Manual" with a self-paced online course hosted on Google Classroom. The SPOC content was sourced from the FutureLearn "Digital Skills for Life and Work" Massive Open Online Course (MOOC). This hybrid approach, delivered through a low-impact blended learning model, aimed at creating a flexible and engaging learning environment for participants. The training program, which used a Blended Learning Model to develop digital skills, undoubtedly resulted in significant improvements in participants' post-test scores compared to their pre-test scores. The results demonstrated statistically significant differences, thereby rejecting the null hypothesis and supporting the alternative hypothesis. The effect size was large, which indicates considerable practical significance. These results suggest that the intervention had a significant impact on developing participants' digital skills. These results align well with previous research and confirm the expected pattern of outcomes (Ayu & Risdianto, 2023; Balula et al., 2019; Bykova et al., 2021; Graham, 2018; Isman et al., 2012; Kelly & McNair, 2021; López-Pérez et al., 2011; Muxtorjonovna, 2020; O'Connor et al., 2011; Patabang et al., 2023; Patmanthara & Hidayat, 2018; Tucker et al., 2009).

6. Conclusion

To recapitulate, the current study investigated the effectiveness of a blended learning intervention on undergraduate students' digital skills using the Digital Skills Assessment Tool (DSAT), a reliable and valid instrument developed by the European Union (European Commission, TEL, 2023). The DSAT was administered as a pre-test and post-test to assess changes in digital skills following a one-semester intervention. This approach allowed for a robust evaluation of both individual and group-level improvements. The quasi-experimental design employed a case study approach with a convenient sample of 15 S5 undergraduate students enrolled in a Bachelor of Excellence program (Yin, 2018). Although limiting generalizability, this approach allowed for detailed insights into the impact of the intervention within a specific context. The sample size, whilst small (n=15), is considered appropriate for a case study and reflects the practical constraints of the research (Stake, 1995). The sample consisted of 60% female and 40% male participants, with the most common age range being 20-22 years. The blended learning intervention combined in-class sessions using the British Council's Basic Digital Skills Training Manual with an online course delivered via Google Classroom and utilizing the DSAT platform. The intervention effectiveness was assessed by comparing pre-and post-test DSAT scores.

Data analysis involved descriptive statistics in characterizing the data and a paired-sample t-test to assess the statistical significance of changes in DSAT scores between pre-and post-tests. Before the t-test, assumptions of normality and homogeneity of variance were checked using Shapiro-Wilk tests and visual inspection of histograms. The results revealed a statistically significant improvement in mean DSAT scores ($t(14) = 2.329$, $p = 0.035$) from pre-test ($M = 211.33$, $SD = 56.29$) to post-test ($M = 256.67$, $SD = 58.63$), representing a large effect size (Cohen's $d = 0.789$) indicating substantial improvement in digital skills following the blended learning program (Cohen, 1992). Further analysis of the descriptive statistics (Table 7) showcased a substantial improvement in the participants' scores on the final exam, reinforcing the positive impact of the blended learning approach on digital skills development.

This study answered the research question of whether blended learning intervention effectively improved participants' digital skills. The results demonstrated a statistically significant and practically meaningful improvement, supporting the effectiveness of the hybrid approach within this specific context. This suggests that blended learning models, incorporating resources such as the British Council manual and online platforms, promise to improve higher education's digital literacy. This low-impact blended learning model could be potentially replicated in other educational settings with minimal resource investment. The study results suggest the potential for broader implementation of similar blended learning interventions to upskill various student populations across different digital skill areas. The use of open-source resources like Future Learn MOOCs makes the BL model adaptable to diverse contexts and resource constraints.

6.1. Implications

This work stresses the need for further inquiry into digital skills training in Moroccan higher education. Future studies should investigate the long-term impact of digital skills interventions, the effectiveness of diverse blended learning models, and their applicability across various demographics

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and disciplines. Moreover, focusing on specific digital skills (development) would be of much value to stakeholders. For practical application, instructors are invited to adopt blended learning models with open educational resources (MOOCs) in order to boost engagement. Regularly monitoring and evaluating specific digital skills are crucial for ongoing improvement and sustained learning. Finally, it is primordial to prioritize funding and promote collaboration with stakeholders through clear messaging. This will ultimately help recognize the utmost importance of digital skills for student success.

6.2. Limitations and Future Work

It is important to acknowledge the following limitations when interpreting the study results and drawing conclusions about the effectiveness of the blended learning intervention:

a) Sample Size:

The small sample size (15 participants, an intact unit, a single class) limits the generalizability of the results to larger populations and diverse student groups. This non-representative sample does not necessarily reflect the broader student body (S5) at the arts and human sciences faculty, UMI, Meknes, or other institutions.

b) Study Design

The quasi-experimental design lacks a control group, making it difficult to isolate the impact of the intervention from other potential influences. The study's short duration (one semester) may not capture the long-term impact of the intervention on digital skills development. Also, the study's limited scope only assessed overall digital skills, not specific skill areas or transfer of learning to real-world contexts.

c) Measurement and Assessment

The single pre-test and post-test design does not account for potential prior knowledge or learning gains outside the intervention. The limited assessment tool, the DSAT, might not comprehensively measure all relevant aspects of digital skills. The study's self-reported data may be susceptible to bias and social desirability.

d) Other Limitations

External factors and uncontrolled variables outside the intervention, such as individual learning styles, motivation, and external support, could influence outcomes. Irrespective of the previously mentioned limitations inherent to quasi-experimental designs, this research design granted a robust and feasible assessment of the intervention impact within the available resources and real-world settings.

Declarations

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About the Contributor(s)

Dr. El Messaoudi, a distinguished lecturer with over 20 years of experience teaching English as a Foreign Language (EFL) and English as a Medium of Instruction (EMI), is a prolific researcher specializing in developing soft skills through blended learning models. His expertise embraces English for Specific Purposes (ESP) and curriculum development and extends to employing innovative pedagogical approaches such as gamification and integrating new media and digital literacies. Holding a PhD in this field, he has authored or co-authored over 20 articles and books. His research methodology skills are robust, incorporating both quantitative and qualitative approaches, and supported by expertise in statistical analysis software (SPSS, MAXQDA, NVivo). Dr. El Messaoudi's extensive contributions to soft skills, digital skills development, and talent building make him a highly respected contributor to discussions on arming university graduates with key skills for the new workplace.

Email: m.elmessaoudi@umi.ac.ma

ORCID ID: https://orcid.org/0000-0002-6236-5254
