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The CAOL framework: Redefining blended learning through asynchronous online communities in Morocco

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Abstract

The sudden shift to online learning in the context of the coronavirus quarantine in Morocco brought to light significant disparities. It led to substantial pedagogical challenges, issues that persist in posing difficulties to educators within the contemporary blended learning environment. The present study investigates the underlying causes of these shortcomings and proposes a novel framework to foster more inclusive and effective digital education. It reveals critical barriers: a widespread lack of appropriate learning technology tools among disadvantaged students, inconsistent access to stable bandwidth connectivity, and a notable scarcity of official, curriculum-aligned digital learning materials. Furthermore, it identifies a prevalent disuse of the Ministry of Education's provided learning management systems by practitioners, who instead resort to more familiar and accessible platforms such as WhatsApp, Facebook, and Google Classroom for remote instruction. In response to these findings, a community of asynchronous online learning framework is proposed. The framework under discussion is structured around four interrelated aspects: affordability, materiality, flexibility, and self-assessment. The intention behind this structure is to cater to the diverse needs of both technologically advantaged and disadvantaged students. Such a framework emphasises offline accessibility and aims to create a resilient, equitable, and effective asynchronous online learning environment that is tailored to the Moroccan reality.

1. Introduction

The rapid global proliferation of technology has significantly transformed education, highlighting the growth of online and blended learning methods. In the context of Morocco, this transformation was anticipated within the 2015-2030 educational reform plan formulated by the Moroccan Supreme Council for Education, Training, and Scientific Research, which included online learning as part of its strategic vision. Nonetheless, a disparity between this aspirational objective and the current state of the national education system was revealed owing to the swift and unplanned transition to digital education amid the COVID-19 pandemic. This sudden shift exposed profound socioeconomic and technological disparities, with numerous students unable to afford the requisite devices or sustain consistent internet connectivity.

This unanticipated transition led to persistent pedagogical challenges within the context of blended learning. Principal obstacles encompassed the deficiency of technological tools, unreliable internet access, and the limited availability of digital resources. A considerable number of educators refrained from utilising official learning management systems, instead favouring accessible platforms such as WhatsApp, Facebook, and Google Classroom. This resulted in a disparity: students from advantageous backgrounds enhanced their learning outcomes, whereas those from disadvantaged circumstances experienced feelings of isolation, thereby exacerbating educational inequality.

The literature highlights challenges such as limited digital learning resources (El Hilali & Moubtassime, 2021, p. 3), unavoidable socioeconomic disparities (Faizi, 2024; Outoukrate et al.,2023; Mounjid & Amrani, 2022; Mounjid et al., 2021), and inadequate technological infrastructure (Bachiri, 2022; Burton et al., 2012), emphasising the necessity for feasible solutions tailored to the specific context. Thereby, this study aims to address these ongoing issues by investigating the reasons behind the unsuccessful online learning experiences in Morocco. Based on these insights, I introduce a new framework called the Community of Asynchronous Online Learning (henceforth, CAOL), which aims to promote a more inclusive and effective digital education system. This paper argues that the challenges of online learning in Morocco are best addressed not by replicating existing models, but by implementing a new, context-specific framework—the CAOL—designed for an asynchronous, offline-first environment.

1.1. Objectives and questions

The objectives of this study are twofold: to explore the factors that have contributed to the challenges of online learning as identified by educational staff at Ibn el-Yassmine High School, and to propose a working framework to facilitate inclusive and effective online learning for all learners, with a particular emphasis on fostering knowledge construction at the learners' appropriate pace. In light of these objectives, the following questions have been formulated:

RQ1: What factors did educational staff at Ibn el-Yassmine high school identify as key barriers to effective online learning during the pandemic?

RQ2: How can policymakers and educators overcome learners' socioeconomic and technological barriers, ensuring accessible and effective online education for all?

2. Literature review

The rapid global integration of technology has profoundly transformed the education sector, markedly increasing emphasis on online and blended learning modalities, particularly in response to the coronavirus pandemic. In Morocco, the swift transition to digital education revealed both substantial opportunities and significant challenges within the national education system during and following the global pandemic. In this context, Bachiri (2022) accentuates this transformation by highlighting the intrinsic connection between education, the internet, and information technology, asserting their pivotal roles in advancing higher education. He stresses that online teaching necessitates new levels of preparedness from both educators and learners, alongside evolving organisational and management practices within institutions. A fundamental principle of effective online learning, as noted by Bachiri (2022), is the adoption of student-centred, tailored pedagogical approaches designed to meet a wide range of academic and professional needs. This methodology fosters flexible and accessible learning environments, enabling educators to leverage a variety of online resources, adapt content, and modify instructional strategies.

Given that effective online learning requires student-centred, individualised pedagogical approaches that offer flexible and accessible experiences, Bachiri (2022) also identifies key shortcomings. These include persistent concerns regarding online assessment, as well as virtual learning constraints in connectivity and network access. Whilst online assessment offers certain advantages, such as greater accessibility and the potential for adaptation for specific needs, concerns regarding participation rates and the occurrence of cheating persist (Gamliel &

Davidovitz, 2005; Burton et al., 2012; Nowell et al., 2010). In a similar vein, Gamliel and Davidovitz (2005) posit that most of the studies in this area indicate a negligible class participation rate in online course assessments in comparison to traditional paper-based assessments. However, a meta-analysis conducted by Burton et al. (2012) shows no significant differences between the two evaluation techniques. They conclude that both modes of evaluation yield analogous results when comparing online and paper-based assessment response distributions, suggesting online assessment does not inherently weigh ratings negatively. Nevertheless, Nowell et al. (2010) find slight positive results in favour of online evaluation. Thereby, the mere translation of conventional offline classrooms into online formats frequently engenders disparities in quality and diminished participation, attributable to students' lack of familiarity with online learning. The transition to online learning, thus, has the potential to result in a sense of isolation and loneliness among learners, owing to the reduced opportunities for direct communication and the absence of a physical campus environment. Notwithstanding the challenges identified, Bachiri (2022) places significant emphasis on the gains of online learning, including such benefits as standardised and meticulously prepared learning resources, scalability, and collaborative opportunities for educators. Furthermore, it is asserted that online learning significantly reduces costs, thereby rendering high-quality education accessible to a broader audience, including those with financial difficulties.

Corroborating many of these observations, Faizi (2024) extensively detailed the student experience during the pandemic in Morocco. His findings reveal that a multitude of barriers impede engineering students from effectively engaging with online learning despite substantial efforts made by educational authorities. In line with Faizi's (2024) findings, Mounjid and Amrani (2022), after surveying over 700 Moroccan teachers, underscore significant challenges, including a notable lack of student interest and limited administrative support during the abrupt transition to online instruction. This finding resonates with international research indicating widespread unpreparedness among both learners and educators for the sudden shift to online instruction (Yusuf et al., 2020; Aboagye et al., 2021; Edelhauser & Lupu-Dima, 2020; Akhasbi et al., 2021; Gormaz-Lobos et al., 2022; El Omari, 2023; Belamghari, 2023). Practically, Outoukrate et al. (2023) find that prior to the pandemic, only a small percentage of Moroccan teachers (approximately 20.2%) had any experience with distance education, and this experience was primarily gained through self-training. Both studies confirm that during the

quarantine period, educators relied heavily on self-directed learning and social media tools to support students, thereby underscoring a conspicuous gap in formal, pre-pandemic preparation.

Faizi (2024) also observes a significant divide whereby students in more favourable conditions were able to enhance their learning, whereas those lacking adequate resources often felt isolated and disengaged, thereby experiencing a severe impact on their academic performance. This contributed to a considerable learning impact on the educational process, resulting in learning losses and exacerbating educational inequality. This socioeconomic disparity is further elaborated by Mounjid and Amrani (2022), who identify poor internet connectivity and students' inability to afford internet costs as major obstacles. Similarly, Outoukrate et al. (2023) underscore significant disparities in access and resources, particularly in rural regions, which aligns with Mounjid et al.'s (2021) findings that educators in urban areas generally possess superior internet access and suitable conditions for online instruction.

In addition to the perspectives previously discussed, Mounjid et al. (2021) confirm that the sudden shift to online classes amid the ongoing Coronavirus crisis presented numerous challenges, which have been shown to vary according to factors such as gender, age, and geographical location of Moroccan educators. It has been observed that there is a notable distinction between the attitudes of men and women towards computers. Specifically, the findings indicate that women tend to approach technology with greater levels of anxiety, fear, doubt, and apprehension than men (Mounjid, et al., 2021; Bain & Rice, 2006; Chiu, Lin & Tang, 2005; Coley & Burgess, 2003; Elliott & Hall, 2005; Smith & Oosthuizen, 2006; Wolin & Korgaonkar, 2003). However, a more recent study offers a nuanced perspective, demonstrating that female teachers exhibit greater interest and possibly increased adaptability toward virtual education, thus suggesting a positive evolution in attitudes over time (Mounjid & Amrani, 2022). Younger teachers, as noted by Mounjid et al. (2021), are more receptive to online education, thereby emphasising age as an influential variable in the transition to virtual learning. Furthermore, educators in urban areas generally possess superior internet access and conditions conducive to online work compared to their rural counterparts.

The findings outlined above detail significant difficulties faced by educators, including a shortage of training for online instruction and ongoing technical problems. These challenges are associated with the novelty of online education in Morocco, which proved to be unsatisfactory due to "resistance to change, negative attitude toward technology and technology use, inadequate resources, lack of experience and skill in technology use" (El Hilali &

Moubtassime, 2021, p. 3). Educators' perceptions of online assessment were largely negative, with many considering it an inefficient method for evaluating student performance. This is particularly relevant considering the assistance provided by virtual classes to sustain pedagogical continuity, which demonstrated encouraging levels of student participation, despite the recognised need for further pedagogical and technical enhancements to optimise their effectiveness. This finding is consistent with the conclusions of Alvi, Bilal, and Alvi's (2021) study, which reported a "sweeping agreement among almost 95% of the participants that teaching and learning English in Medicine through the traditional face-to-face approach is considerably superior and more effective than online learning" (p.344). This scepticism is attributed to a perceived lack of professional training from the Ministry of National Education regarding the effective integration of technology and the delivery of online classes. Consequently, Mounjid et al. (2021) recommend providing educators with complimentary internet access and devices, along with professional training opportunities in technological resources for online education, to enhance the efficacy and competitiveness of teaching and learning operations.

Notwithstanding the global evolution of online learning, many countries, including Morocco, have been unable to adapt fully, even post-pandemic. The challenges highlighted by the aforementioned literature – unescapable socioeconomic disparities, inadequate technological infrastructure, teacher unpreparedness, and insufficient digital learning resources – underscore a critical need for context-specific solutions. This study was conceived during the national quarantine, emerging from a conviction that its proposed concepts remain pertinent for enhancing educational systems, particularly through asynchronous blended learning. Its content still aligns with the Moroccan Supreme Council for Education, Training and Scientific Research's long-term strategic vision (2015-2030) for integrating online learning (CSEFRS, 2014), acknowledging that a significant portion of this reform period has elapsed without robust implementation. Therefore, the objectives of this study are twofold: to explore the factors that have contributed to the failure of online learning in Morocco, and to propose a working framework to facilitate inclusive and effective online learning for all learners, with a particular emphasis on fostering knowledge construction at the learners' appropriate pace.

3. Materials and Methods

The present qualitative study employed a focus group discussion as its primary data collection method. The selection of this approach was made with the intention of leveraging the collective insights, diverse perspectives, and interactive dynamics of a group setting, which are particularly valuable for exploring complex phenomena such as the adoption of online and blended learning. The discussion was conducted on three occasions: initially at the onset of the pandemic, with the objective of exploring the opportunities presented by the Ministry; subsequently, fifteen days after the initiation of the quarantine, with the aim of evaluating the efficacy of the methods employed by teachers; and finally, at the end of the school year, to undertake a comprehensive evaluation of the overall online learning approach.

3.1. Participants

The participants in this study comprised 17 staff members from Ibn el-Yassmine High School in Taza, Morocco. The selection aimed to provide a representative sample of the school's instructional and administrative personnel, with the objective of capturing a comprehensive understanding of the challenges and opportunities associated with online and blended learning within the institutional context. The participant group comprised the following individuals: Nine subject-matter teachers (each teacher was responsible for a distinct subject discipline, with the subjects on offer including, for example, Mathematics, Arabic Language, French Language, English Language, Physics and Chemistry, Life and Earth Sciences, History and Geography, Philosophy, as well as Physical Education). It is noteworthy that the researcher was a member of the teaching staff at this institution, specifically serving as the head of the English language group at the time of the study. Four education supervisors; one study supervisor, one counsellor, one reporter and the head of the school, who served as the meeting monitor. The school principal offered a crucial administrative and strategic perspective on policy implementation, resource allocation, and institutional vision regarding digital learning. The total of 17 participants was deemed sufficient to facilitate a rich discussion while maintaining a manageable group size that allowed for active participation from all members.

3.2. Data collection method

Data was collected employing a focus group discussion, which was conducted during the period of the national Coronavirus quarantine. Such circumstances necessitated a remote format for the discussion. This context was particularly pertinent, as it directly related to the practical

application and challenges of online and blended learning during an unprecedented shift in education. Notably, the entire discussion process was overseen by the head of the school, who actively ensured equitable participation and formally granted consent for the utilisation of the collected data and the discussion report for the sole purpose of this research. The three meetings emphasised several key themes, including but not limited to:

- The practical experiences of teachers and staff with online and blended learning during the quarantine period.
- The perceived pedagogical gains and advantages of integrating online and blended learning approaches.
- Pitfalls, challenges, and barriers encountered during the implementation of these learning modalities. These issues include, but are not limited to, technical issues, student engagement, assessment difficulties, and teacher preparedness.
- The potential for the future integration and development of online and blended learning within the school's educational framework is a subject that warrants further consideration.
- Suggestions are put forward to enhance the effectiveness and equity of digital learning initiatives.

A detailed record was made of the discussion, and with the principal's informed consent, the reporter provided the relevant documentation to ensure accuracy and enable thorough thematic analysis. The confidentiality and anonymity of individual responses were maintained throughout the data collection and analysis process.

3.3. Questions

To reiterate, this study aims to explore the factors that have contributed to the failure of online learning in Morocco and to propose strategies that policymakers and educators could implement to facilitate online learning for all learners. It also examines the current state of online education in Morocco and seeks to formulate a working framework for online learning. In light of these objectives, the following questions have been formulated:

RQ1: What factors did educational staff at Ibn el-Yassmine high school identify as key barriers to effective online learning during the pandemic?

RQ2: How can policymakers and educators overcome learners' socioeconomic and technological barriers, ensuring accessible and effective online education for all?

4. Results: Identifying the Core Challenges

The sudden shift to online education by the Ministry of Education during the global pandemic presented significant challenges, as perceived by the educational staff at Ibn el-Yassmine High School. Their insights notably draw criticism for their perceived oversight of students' diverse socioeconomic backgrounds and technological capabilities. While the Ministry integrated learning systems within MASSAR, a novel online school information management tool that also facilitates parental monitoring (Saber, 2015), a more direct tool for remote instruction was Microsoft Teams, a dedicated Learning Management System (LMS). MASSAR also allows for parental monitoring of their children's school life, encompassing aspects such as class schedules, academic performance, and attendance, through a personal login and password (ibid). In contrast, Microsoft Teams is an LMS designed for learning and teaching. However, it is noteworthy that the absence of prior training on its utilisation hinders the full realisation of its potential benefits, says one of the participants. In this regard, Amzazi (2020) states in the House of Councillors meeting that the Ministry of Education, in partnership with the University of Mohamed the 6th, has launched a green phone number for students, parents and teachers to call and ask about how to use these online platforms; viz, TelmidTICE and Microsoft Teams. One participant highlights that neither students nor teachers have received any training on how to utilise these new technology applications in constructing learning and designing teaching materials and assessment tools, as the functionality of these platforms was contingent upon an active internet connection. A few others agree that this issue poses a critical challenge given their fundamental misalignment with the socioeconomic disparities of students, including a pervasive lack of financial resources to procure learning technology tools such as tablets, PCs or smartphones, and consistent bandwidth. Concurrently, policymakers have not allocated sufficient resources to provide these tools to students. Those who already possess the necessary equipment are unable to maintain consistent access to bandwidth connectivity, a situation that leaves less than 10% (600.000 out of 6.260.444) of students benefiting from online platforms (Amzazi, 2020). This predicament has compelled teachers to adopt technology tools such as Facebook and WhatsApp, as noted by some participants, due to familiarity and economic accessibility, in order to facilitate online learning.

These technology tools, although not all teachers and students in this school possess a high level of technological proficiency, are updated daily, semi-weekly, or weekly with informative, level-related teaching materials. In response to these challenges, educators have adopted various

technological gadgets to facilitate remote learning, including voice and video calls, the creation of summaries, simulations, and videos, which are then disseminated to students to ensure the continuity of the curriculum. When considering the financial limitations of the students, it becomes evident that the majority of them were unable to cope with the learning demands imposed by their instructors. One participant declares that engagement in Teams is only observed among one out of thirty-five students. Another participant also posits that the majority of his students lack both technological devices and internet access, which hinders their engagement in online learning. The remaining others confined their engagement to the materials that were made available via television.

The TV approach, which the Ministry of Education adopts to cover the rest of the curriculum, appears inadequate in the 21st century when technology tools and learning materials are available in a variety of forms and types. Television and radio present a distinct challenge in facilitating interaction, as their very nature is incompatible with the fundamental objective of the syllabus, which is to facilitate communication. This inherent challenge is further compounded in the context of language education, leading to ambiguity that pervades the learning environment. This approach is not universally applicable, particularly in consideration of inclement weather conditions, such as rain and wind, which can impede television broadcasting. Moreover, a 2015 study conducted by the Office of the High Commissioner for Planning revealed that 12% of Moroccan families do not possess a television, thereby resulting in disparities in educational opportunities (Amzazi, 2020). Nevertheless, the television may be employed as a supplementary instrument in the pursuit of learning. Consequently, there is an emerging need for a framework that can keep pace with evolving learning objectives, utilising 21st-century technology tools and catering to the diverse socioeconomic backgrounds of students.

The general unfamiliarity of both teachers and students with LMS, as highlighted by Mounjid et al. (2021) regarding "resistance to change, negative attitude toward technology and technology use" (p. 49), further contributed to the ineffectiveness of these systems. Most critically, the profound socioeconomic disparities among students severely hindered sustained online engagement. As noted by the head of the school, concerns expressed via voice messages from parents regarding their inability to constantly afford internet access for their children resulted in a considerable number of students disengaging from learning platforms before the first month of the COVID-19 quarantine elapsed. These practical shortcomings, corroborated

by another participant, who deemed the use of Microsoft Teams for online teaching a severe failure in his school, underscore the imperative for a new framework. The conceptualisation of the CAOL framework was thus derived directly from observations of these widespread challenges during Morocco's rapid shift to online learning. As one of the participants noted, the inadequacy of existing solutions, like Microsoft Teams, was strikingly apparent, particularly in conducting large-class video calls where voice communication was frequently compromised due to platforms being developed to meet the needs of teams, not large classes. Drawing on these foundations, the CAOL framework has been developed to directly address these critical shortcomings by prioritising offline accessibility, user-friendliness, and cost-effectiveness, aiming to establish a more equitable and effective asynchronous online learning environment tailored to the Moroccan reality.

5. Discussion: The CAOL Framework as a Proposed Solution

5.1. The utility of the CAOL framework

This study's primary contribution is the development of the CAOL community, a proposed model for blended learning in the Moroccan context. This framework explicitly emphasises an asynchronous mode of education, designed to address previously identified challenges and capitalise on the opportunities offered by digital learning, as evidenced in the existing literature. This framework posits that effective asynchronous online learning is contingent upon learners assuming ownership of learning technology devices. These tools are conceptualised as platforms supplied with educational materials that "show themselves" (Kraus, 2012), implying self-explanatory and intuitively navigable content. This aligns with Bachiri's (2022) concepts regarding the standardisation of learning gadgetry and meticulous preparation of learning resources relevant to a vast number of learning groups, hence ensuring that learners can engage with content autonomously.

It is proposed that the CAOL framework be articulated within a user-friendly learning application or program, accessible via both mobile devices and personal computers. This interchangeably directly addresses the accessibility concerns raised by Faizi (2024) and Bachiri (2022), who highlight the need for flexible access to educational content. Crucially, this application is designed to include all educational levels, from primary to high school, featuring subject matter-related materials designed to address learning gaps independently of instructor presence. The presentation of learning materials in diverse formats and methods – such as

"micro-class videos or audios" (p. 21) as suggested by Bachiri (2022), and "abundant videos, audios, and images" (p. 25) as described in the gains of online learning – aims to accommodate diverse learning styles and strategies, fostering the personalised learning that Bachiri (2022) identifies as the development direction of online learning.

The CAOL framework represents a less resource-intensive online educational model, benefiting both students and educators. It advocates for learning fundamentally through this dedicated application, which offers students a comprehensive description of concepts and components related to level-specific materials. A significant feature is the accessibility to content even without consistent bandwidth connectivity, hence addressing a critical limitation identified by Faizi (2024) and Mounjid et al. (2021) regarding internet access, particularly in rural areas. This offline accessibility aligns with the concept of disturbing content via "CD-ROM or other information storage devices" (p. 22) as underscored by Bachiri (2022) for low-connectivity scenarios. Additionally, the framework enables students to assess their performance to gauge their understanding and reflect on their learning progress through numerous features that advocate for learners to interact with peers, teachers, and education counsellors. This is because extensive, usual communication between teachers and students is often lacking in online settings, which leads to "isolation and loneliness" (Bachiri, 2022, p. 23). Therefore, this framework seeks to mitigate this by providing structured avenues for interaction. Crucially, taking into account that much of the learning is asynchronous, interaction with education counsellors or assistance during office hours necessitates occasional bandwidth connectivity.

This framework has been developed not only to address students' pedagogical and access needs, but also to consider the challenges faced by teaching staff, administration personnel, and education counsellors. By integrating these various components of the educational institution within the CAOL framework, it purports to facilitate learning and assist learners in overcoming documented educational barriers, such as "scarcity of training for delivering online or virtual classes and "technical issues" (Mounjid et al., 2021, p. 49), and to promote better coordination and resource management within the educational institution system.

5.2. Aspects of the CAOL framework

The CAOL framework is a proposed learning paradigm specifically designed to function asynchronously, hence minimising inherent reliance on continuous bandwidth connectivity.

This framework is conceptualised as a learning application installed on various personal learning technology tools, encompassing personal computers, smartphones, tablets and smart TVs. The objective behind its design is to overcome significant digital divide challenges, particularly prevalent in contexts like Morocco, by providing educational content and functionalities that are broadly accessible offline. The CAOL framework is structured around four interconnected core components, each designed to address a critical dimension of the learning experience and overall educational ecosystem. The relationship between these four components is illustrated in Figure 1. These dimensions are affordability, materiality, flexibility, and assessment. In other words, these components merely meet economic realities, knowledge construction, interaction, and evaluation perspectives.
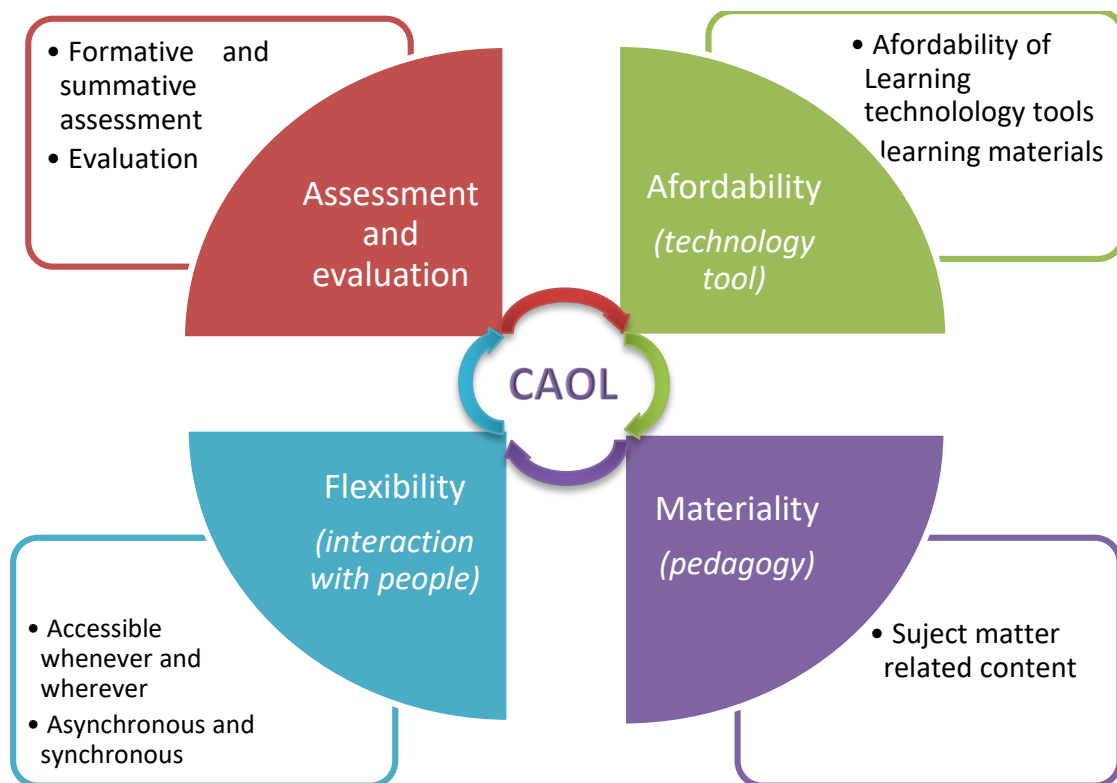
Figure 1. The CAOL Framework

5.2.1. *Aspect 1. Affordability*

In the context of the CAOL, affordability is defined beyond merely the cost of online courses themselves. It primarily refers to the significantly reduced or non-existent financial barrier to accessing a wide range of educational resources and high-quality courses, thereby making learning more accessible to individuals who might otherwise be precluded by the prohibitive

cost of traditional, often expensive, offline education. Crucially, within this paper, affordability is extended to encompass the imperative of providing learners with access to and ownership of appropriate learning technology gadgets and the digital teaching materials necessary to establish a successful and effective online learning environment. This critical mission falls squarely on the shoulders of policymakers and educators, particularly in a country like Morocco.

Based on internal statistics provided by the Moroccan Ministry of Education, some students may possess the necessary technological tools, such as computers, tablets, smartphones, and/or smart televisions. In contrast, a significant portion of the student population lacks access to such devices. This disparity was starkly highlighted during the COVID-19 quarantine period, when 5.1 million families classified as impoverished received financial assistance (Amzazi, 2020). The absence of appropriate technological tools for online learning constitutes a substantial barrier, effectively excluding a considerable number of students who are accustomed to relying solely on printed textbooks. Therefore, ensuring the affordability and accessibility of these fundamental technological resources is not merely advantageous but an essential prerequisite for establishing a functional and inclusive community of asynchronous learners within the CAOL framework. This focus on offline accessibility directly addresses the digital divide identified in studies such as Faizi (2024), Mounjid and Amrani (2022), and Bachiri (2024), which reveal that poor internet connectivity and students' inability to afford devices and internet costs remain significant obstacles to online learning.

5.2.2. *Aspect 2. Materiality*

Once the fundamental issue of affordability for technology devices is addressed for all learners, the subsequent critical step in the CAOL framework is the provision of meticulously designed pedagogical materials, which constitute the essence of the materiality component (see Figure 2). This aspect focuses on fostering independent knowledge construction by providing subject matter content that effectively "shows itself" (Kraus, 2012), viz, it is intuitively designed and comprehensively explained, enabling learners to grasp concepts without constant, real-time instruction. This aligns with Bachiri's (2022) call for standardisation and meticulously prepared resources that promote personalised learning by allowing students greater autonomy. The framework's commitment to centralising unified and diverse learning materials directly addresses the findings of Outoukarte et al. (2023) and Mounjid and Amrani (2022), who both

observed a heavy reliance on social media and self-sourced materials due to a lack of official, curriculum-aligned resources.

To achieve this self-sufficient learning, subject matter content within the CAOL framework must be provided in diverse formats. These include written documents (e.g., PPT, PDF, Doc, Docx), high-quality images, clear audio explanations, engaging videos, and interactive simulations. This multi-modal approach is vital for accommodating various student learning styles and strategies, thereby enhancing student engagement with the content and stimulating a more profound desire for learning. As Bachiri (2022) notes, "abundant videos, audios, and images give learners a good learning experience and are very helpful for enhancing the learning effect" (p. 25), contrasting this with traditional methods often limited to texts only.

The subject matter content within the CAOL framework is systematically orchestrated following a module or unit approach, hence facilitating easy navigation through its various components. For instance, similar to the unit-based design of a Baccalaureate English language textbook, each unit covers a specific theme through integrated lessons in vocabulary, the four skills, grammar, and culture. Also, the CAOL framework follows a logical and progressive organisation of the content. This structured presentation supports continuous, self-paced learning, ensuring that an art stream baccalaureate student, for instance, can enrol in all relevant subjects—such as Arabic, English, French, Philosophy, Islamic Studies, History and Geography, Mathematics, Physics, Biology and Physical Education—at the beginning of the academic year. The pre-loaded content allows students to navigate materials at their own pace, staying aligned with the curriculum even if direct interaction with teachers is less frequent.

The core principle is that the CAOL application functions predominantly asynchronously once the application is installed, specifically catering to learners who face challenges with consistent network connectivity. The main learning content remains available offline, with the application allowing for periodic updates (daily, semi-weekly, depending on network availability). This enables participation in discussion forums, peer-to-peer assistance, direct instructor queries, and guidance requests for education counsellors, in addition to follow-up on learners' progress. This blend of offline content delivery with scheduled online interaction is critical for fostering a robust learning environment where students can actively engage with learning themes and seek support as needed.
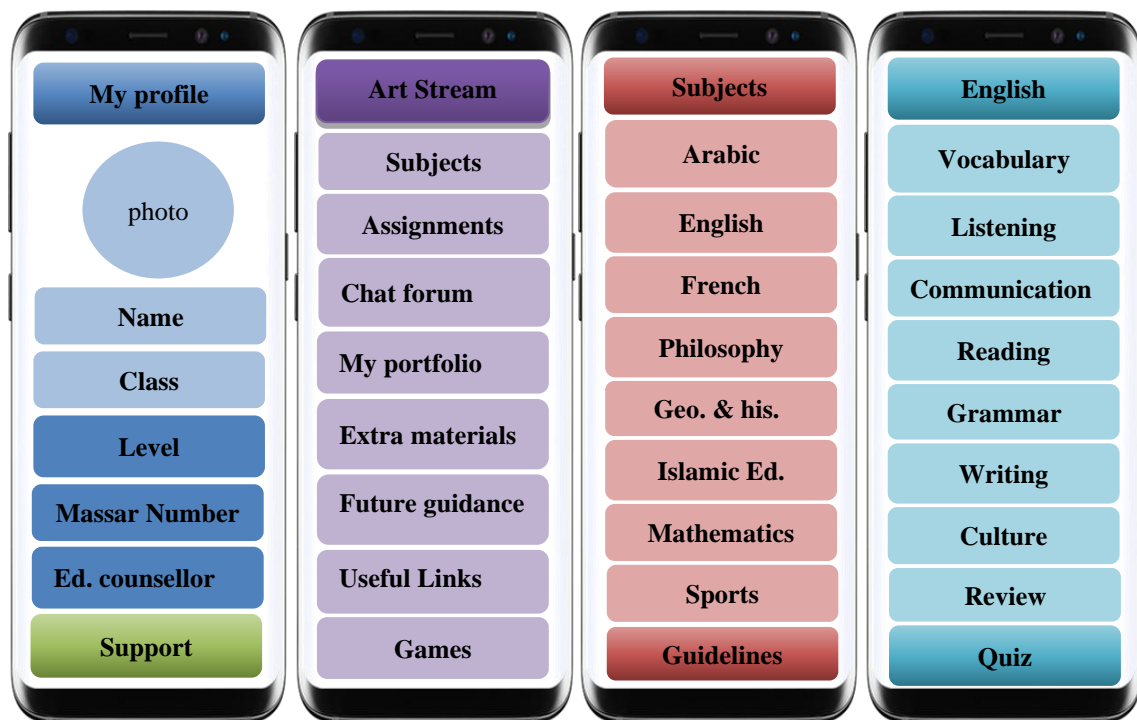
Figure 2. Interface design of a learning mobile application/PC program in the CAOL framework

The "Useful links" feature within the CAOL framework enhances materiality by providing curated access to subject-relevant online resources. This feature directs students to verified educational websites or applications, effectively saving time and maintaining focus by preventing them from aimlessly navigating broad search engines, ensuring that supplementary resources directly contribute to their study goals.

5.2.3. *Aspect 3. Flexibility*

The CAOL Framework is primarily designed to render online learning highly flexible and accessible, explicitly addressing the diverse needs of all students, irrespective of their socioeconomic disparities or inconsistent internet access. This aspect allows learning to transcend traditional constraints of time, place, and connectivity, fostering a truly student-centred environment. Fundamentally, subject matter content is accessible asynchronously for learners to engage with at their own pace and convenience, independent of real-time instructor presence or a continuous internet connection. Once the CAOL application is installed on their preferred learning technology tool, students gain immediate and uninterrupted access to the educational materials. They can navigate through the content, scrutinise learning materials, review previously learned concepts, and undertake self-assessment upon completing each unit

or module, all offline. This offline capability directly mitigates the barriers imposed by inconsistent or unaffordable bandwidth connectivity, a critical issue highlighted in the Moroccan context (Faizi, 2024; Mounjid et al., 2021).

This inherent flexibility allows students to tailor their learning journey to their individual schedules, learning styles, and cognitive pace. Given that the core learning process is asynchronous and largely offline, teachers can monitor students' progress both within the traditional classroom setting and, when network services are available, through data synced via the application. This dual feedback mechanism provides students with a double-faceted feedback loop: immediate, automated, asynchronous feedback from the application's embedded assessments, complemented by detailed descriptive feedback on their improvement from their teachers.

Cooperation and collaboration. Within this flexible framework, the CAOL promotes robust cooperation and collaboration among learners. Students can undertake assignments such as project works, reports, and exercises by collaborating with their peers both asynchronously and, when connectivity permits, synchronously. This enables them to cooperate remotely on projects and submit their work through the application, adhering to established deadlines for teacher evaluation and grading. Such distanced cooperation, facilitated through features like chat forums, is designed to enhance class dynamics and foster a level of engagement that might not always be achievable in traditional face-to-face learning environments. This directly addresses the "sociability limitations" and "sense of isolation and loneliness", as noted by Bachiri (2022, p. 23), that can arise in online learning by providing structured avenues for peer interaction and support.

In conjunction with collaborative project work, the CAOL framework integrates the concept of e-portfolios as a crucial tool for monitoring and promoting student progress. For educators, the e-portfolio serves as a dynamic repository that showcases students' incremental advancements and areas of improvement, as well as identifies specific weaknesses or challenges they encounter. This comprehensive overview provides teachers with invaluable insights for delivering targeted guidance and instruction. For students, the e-portfolio offers a tangible reflection of their learning journey; all submitted assignments become part of this digital compilation, enabling them to visually gauge their levels of improvement and experience a sense of accomplishment and ownership over their work. In essence, the e-portfolio fosters greater learner responsibility and self-directedness, shifting the primary burden of learning

progression onto the students themselves, while still providing avenues for teacher support and feedback within this flexible learning ecosystem.

Modes of Interaction. In the context of this framework, the CAOL promotes robust interaction among all stakeholders (see Figure 3), recognising its paramount importance for effective knowledge construction (Moore, 1989). Drawing on Moore's (1989) foundational work, which identified three primary types of interaction –namely, with content, the instructor, and other learners– Hillman, Willis, and Gunawardena (1994) proposed a fourth dimension: interaction with the interface. The CAOL framework builds upon and integrates these forms of interaction, positioning the interface as a central mediating element between the learner and other contributors. Moreover, it expands upon the model by incorporating a fifth layer of interaction: engagement with educational counsellors, thereby addressing learners' academic and emotional support needs within an adaptive learning environment.

Interaction with content: Content forms the fundamental entity in the process of knowledge construction. Learners independently interact with digital content (e.g., PDFs, videos, simulations, interactive exercises) asynchronously within the application. As Moore (1989) articulated, this "intellectually interacting with content" (p. 2) facilitates changes in the learner's understanding and cognitive structures. This asynchronous engagement with self-explanatory materials provides students with food for thought before physical or online class sessions, enabling them to inquire into what they read, listen to, or watch by jotting notes, reflecting, formulating questions, and solving problem sets, thus allowing for deeper exploration during subsequent synchronous activities.

Interaction with instructors: Students can asynchronously reach their instructors to inquire about concepts they find difficult to grasp or seek clarification on assigned materials. This flexible approach allows for support tailored to the student's pace. As Moore (1989) noted, a proficient teacher stimulates interest, motivates, directs, organises, supports, encourages, and assesses learning. While the primary mode can be asynchronous (e.g., chat forums, audio/video messages), synchronous options (e.g., instant messaging, audio/video calls when connected) are also available, ensuring tailored support, including for students with special needs requiring extra guidance.
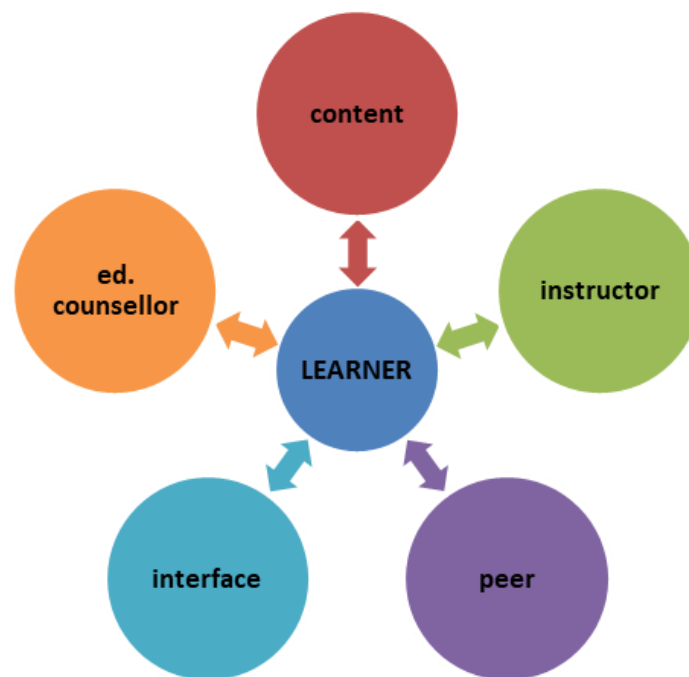
Figure 3. The various modes of interaction facilitated within the CAOL framework.

Interaction with peers (Cooperation and Collaboration): Learner-to-learner interaction, defined as communication and collaboration between two or more online class members (Moore, 1989), is vital for social integration and enhanced engagement. Students can undertake assignments like project work and exercises by collaborating with peers both asynchronously and, when connectivity permits, synchronously. This enables remote cooperation and submission through the application, fostering positive relationships and allowing for the continuation of classroom discussions in chat forums, thereby enriching the learning atmosphere and mitigating "sociability limitations" (Bachiri, 2022, p. 23).

Interaction with interface: This fundamental interaction involves the specific technologies, media, platforms, and applications students utilise to interact with content, teachers, and classmates (Hillman, Willis, & Gunawardena, 1994). The CAOL framework emphasises a well-designed, intuitive application interface, as its practical use can significantly influence the quality and quantity of all other interactions (Wang, 2008), ensuring seamless navigation and engagement.

Interaction with educational counsellor: Uniquely, the CAOL framework integrates interaction with an educational counsellor as a crucial type of support, aiming to mitigate academic misguidance. Given the challenge of a sufficient number of counsellors in the Moroccan context to provide personalised guidance for every student, this framework leverages technology to

enhance their reach. Counsellors may organise asynchronous webinars, leaving recordings for absent students, and maintain consistent contact through chat forums, video, and/or audio calls (when connected). This enables them to track students' choices regarding future disciplines and ensure informed decision-making. This consistent accessibility allows students to actively seek answers to pressing questions about their academic and vocational choices, a cardinal means to alleviate uncertainties about their future study paths.

The flexibility aspect of the CAOL framework combines accessibility, personalised pacing, and a comprehensive approach to interaction, intending to create a robust and adaptable learning environment that is tailored to the diverse realities of Moroccan students. Beyond these fundamental interactions, the CAOL framework fosters enhanced flexibility and engagement through the implementation of gamification strategies.

Gamification (engaging learning through play). The CAOL framework is notable for its incorporation of a gamified approach to learning. This feature is increasingly recognised as being relevant in educational settings, particularly in addressing low attainment issues observed on a global scale. As Ofsted (1993) observes, disparities in attainment, particularly among male students in language-based subjects, are an international trend, prompting educators to explore alternative motivators. A study conducted in Oujda high schools in Morocco confirms higher female participation and performance, partly due to their use of more diverse learning strategies, alongside a keen interest among learners in using movies as an English learning strategy (Dahmani, Benchbir, & Bayout, 2020). These findings emphasise the imperative of engaging, gender-inclusive motivators, such as learning games, in order to maintain student interest.

Games within this framework serve a dual objective: to facilitate learning and to provide entertainment. The CAOL framework is predicated on the premise that students' existing engagement with non-educational games, such as Free Fire, among others, in the classroom might be utilised as a foundation for the inclusion of educative games. The objective of this incorporation is to capture and maintain students' attention and motivation, as "motivation plays a crucial role in the success of gamified learning environments" (Detken Landázuri et al., 2025, p. 17), which, according to Lee & Baek (2023), has a significant impact on English language learning ($g = 0.517$). In line with Lee and Baek's findings, Zhang and Hasim (2023) contend that gamification has proliferated in EFL/ESL instruction for reasons including improving language skills, positively affecting student attitudes, and cultivating comprehensive

competence. This directly addresses the challenge of low student engagement and lack of interest in online classes (Outoukrate, 2023; Mounjid & Amrani, 2022).

These games are envisaged as versatile tools, employable in various pedagogical activities, including lesson openers, summary activities, or as a general source of entertainment and motivation when learners' engagement wanes. Learners who perceive learning activities as enjoyable, intellectually stimulating, and fulfilling tend to dedicate persistent effort to language practice (Detken Landázuri et al., 2025). It is essential to note that gamification also plays a central role in fostering critical thinking and problem-solving skills. The integration of games within the framework provides an effective alternative for students who find traditional teaching strategies monotonous. This approach addresses potential sources of inadequate motivation and contributes to improved learning achievement. This proactive inclusion of games represents a deliberate strategic shift, emphasising their role as a vital teaching strategy within the curriculum.

5.2.4. *Aspect 4. Self-assessment*

The fourth aspect of the CAOL framework is concerned with the strategic integration of various assessment approaches. These approaches are designed to enhance learners' knowledge construction and enable instructors to monitor this progress effectively. This feature is particularly important for addressing the negative perceptions of online assessment, as documented by Mounjid et al. (2021), and for providing educators with the pedagogical and technical tools they lacked during the pandemic (Outoukrate, et al., 2023). The overarching objective of this programme is to empower students to take greater responsibility for their learning from an early age by equipping them with the tools for self-reflection and performance evaluation. The framework incorporates a tiered assessment model:

Diagnostic Test: Prior to commencing a new educational level or subject module (e.g., at the beginning of the school year, module, or unit), students are required to undertake a diagnostic test. The initial assessment is designed to evaluate the students' pre-existing knowledge and identify any foundational learning gaps. The application provides immediate, automated feedback, pinpointing specific areas of weakness and guiding students to prerequisite content or previously missed topics within the database. This functionality enables students to review and consolidate prior knowledge, thereby facilitating enhanced mastery. It is important to note that students in question have the flexibility to redo these diagnostic assessments. These are

typically rescheduled during the summer vacation period or at the commencement of the academic year, prior to the progression of students to new lessons. This proactive approach ensures a solid foundation for subsequent learning.

Formative Assessment: In each section of the module or unit, students are encouraged to undertake formative quizzes that are designed to evaluate their comprehension of the subject-specific knowledge. The self-assessment component in question offers two distinct benefits: For students, the programme provides a comprehensive analysis of the participants' responses, highlighting areas of weakness and directing them to specific items requiring further review and mastery before progression. This targeted feedback has been shown to save students considerable time and energy, allowing them to consolidate understanding and progress more efficiently before formal in-class examinations. For Teachers, the scores and analytical data from these self-assessments are, in the event of network connection, automatically updated in the teacher's dashboard within the application. This provides instructors with a comprehensive overview of the class's collective strengths and weaknesses, thereby significantly streamlining the process of identifying common misconceptions or areas of difficulty. Consequently, teachers are able to design supplementary teaching materials or adapt their in-class instruction to specifically address these identified learning gaps, thereby enhancing overall student achievement. This finding is consistent with Bachiri's (2022) assertion that online assessment may "reflect the quality of teachers' online teaching to a certain extent". It serves as an "important reference for the coordination and completion of various tasks during the course teaching management process" (p. 22).

Summative Assessment: Whilst traditional summative assessment is generally characterised by the act of grading that occurs after the closure of a module, course or semester, the summative assessment component within the CAOL framework does not necessarily result in formal grading. The primary function of the system is to enable students to assess their knowledge concerning the subject matter at the end of a semester or academic year. This assessment has been meticulously constructed to assist learners in gauging their comprehensive performance and readiness prior to engaging with high-stakes final examinations, such as national baccalaureate exams. It provides a crucial opportunity for self-evaluation and final preparation, reinforcing the framework's emphasis on learner responsibility and self-directed learning.

The present study acknowledges several limitations that constrain the scope of its findings. Firstly, the investigation relies exclusively on the perspectives of educational staff, without

incorporating learners' viewpoints, resulting in an incomplete understanding of the blended learning experience. Secondly, the analysis is primarily contextualised by the specific challenges encountered during the quarantine period in Morocco due to the 2019 pandemic, although these challenges continue to persist. The findings from the aforementioned studies corroborate that the core issues, including the digital divide and inadequate teacher training, were not temporary but rather systemic problems that were intensified by the crisis. Thirdly, this study employs a single focus group at one high school as a means of data collection, which restricts the extent to which the findings can be generalizable. Lastly, considering that the proposed CAOL framework is theoretical, its practical implementation and long-term efficacy remain to be empirically validated through the development of an application intended to serve this purpose. Given the significant and persistent challenges documented in the literature, empirical validation of the CAOL framework is an essential subsequent step to ensure its practical effectiveness in the Moroccan context.

6. Conclusion

The CAOL framework is proposed as a significant theoretical and practical contribution to blended learning. Driven by the overarching objective of establishing an accessible database of high-quality learning materials that operates without continuous bandwidth, it directly addresses socioeconomic disparities in educational access. This core objective, in response to the issues of poor internet connectivity and learners' inability to afford devices and internet costs, is supported by four fundamental motivations, which shape the framework design. Firstly, the aim is to provide a user-friendly learning application that can be installed on a variety of personal devices, thereby reducing technical barriers. Secondly, there is a commitment to centralising unified and diverse learning materials that cater to varied learning styles and foster autonomous and flexible learning. Thirdly, the objective is to cultivate a dynamic environment that supports multifaceted interactions, including peer collaboration, instructor support, and personalised guidance from education counsellors. Finally, the goal is to enhance learner autonomy through integrated self-assessment tools, empowering students to monitor and take ownership of their educational progress. The CAOL framework, then, advocates for the strategic integration of offline accessibility, personalised pacing, diverse interactive modalities, and robust self-assessment mechanisms, with a critical emphasis on asynchronous online delivery. The objective is to create a more resilient, equitable, and

effective educational ecosystem, particularly vital for regions confronting digital divide challenges.

The proposed CAOL framework, which accentuates offline accessibility and asynchronous delivery, provides feasible and context-specific solutions to the systemic issues of the digital divide as well as inadequate pedagogical support. This study outlines a significant prospect for educational policymakers seeking to align educational technology with the long-term strategic vision proposed by the Moroccan Supreme Council for Education, which aims for a more equitable and quality-driven educational ecosystem. As a theoretical model, its successful implementation depends on the consensus and dedication of institutions and educators, and thus, its empirical validation remains an essential subsequent step for the effective implementation of this framework.

Disclosure Statement

The authors declare that there is no conflict of interest regarding the publication of this article. No financial, personal, or professional relationships have influenced the research, analysis, or conclusions presented in this work.

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