An in-depth analysis of a tutoring solution by digital technology

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Article Info

ABSTRACT

In Morocco, the dropout rate in primary and secondary education remains high due to environmental, social, familial, and educational factors. To address this issue, students rely on private tutoring or online platforms. However, socio-economic disparities make private tutoring inaccessible to many, while technical and pedagogical challenges limit the effectiveness of online platforms, deepening educational inequalities. This article proposes a nationwide participatory tutoring approach involving educational administration and teachers to ensure equitable and quality learning. We analyze existing models to identify their limitations and propose a structured tutoring system tailored to different student profiles. This system is based on a specific algorithm that defines skill assessment, remediation, and progress tracking. Unified modeling language UML is used to structure and present our approach in detail. Then, we compare current Moroccan platforms, particularly Massar, with our system, evaluating student engagement, pedagogical monitoring, curriculum alignment, and remediation effectiveness. Finally, we discuss our results, highlighting our system's potential to reduce learning gaps, improve education, and significantly decrease the dropout rate in Morocco.

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1. INTRODUCTION

In Morocco, students face significant challenges throughout their education, particularly in scientific subjects. Statistics from the Ministry of National Education indicate that more than 300,000 students dropped out of school during the 2019-2020 academic year [1]. More precisely, 76,574 students dropped out of primary school, representing 2.1%, compared to 95,191 (2.7%) in the previous year [2]. In secondary school, the dropout rate decreased from 8.8% to 7.4%, dropping from 80,560 learners to 67,134 [3]. More statistics in Figure 1 reveal that the number of young people leaving school remains consistently high and has not decreased [4].

Moreover, according to the Moroccan Ministry of the Interior [5], various factors influence student retention and success, both positively and negatively [6]. These factors are interconnected and can be classified into four groups: environmental or social causes, family-related causes, personal causes, and educational causes (such as the quality of education and learning difficulties) [7]. When these factors have a harmful effect, they represent risk factors that increase the likelihood of students experiencing further difficulties, which can lead to school dropout [8]. The Ministry of National Education reports that grade repetition is a persistent problem with multiple causes [9].
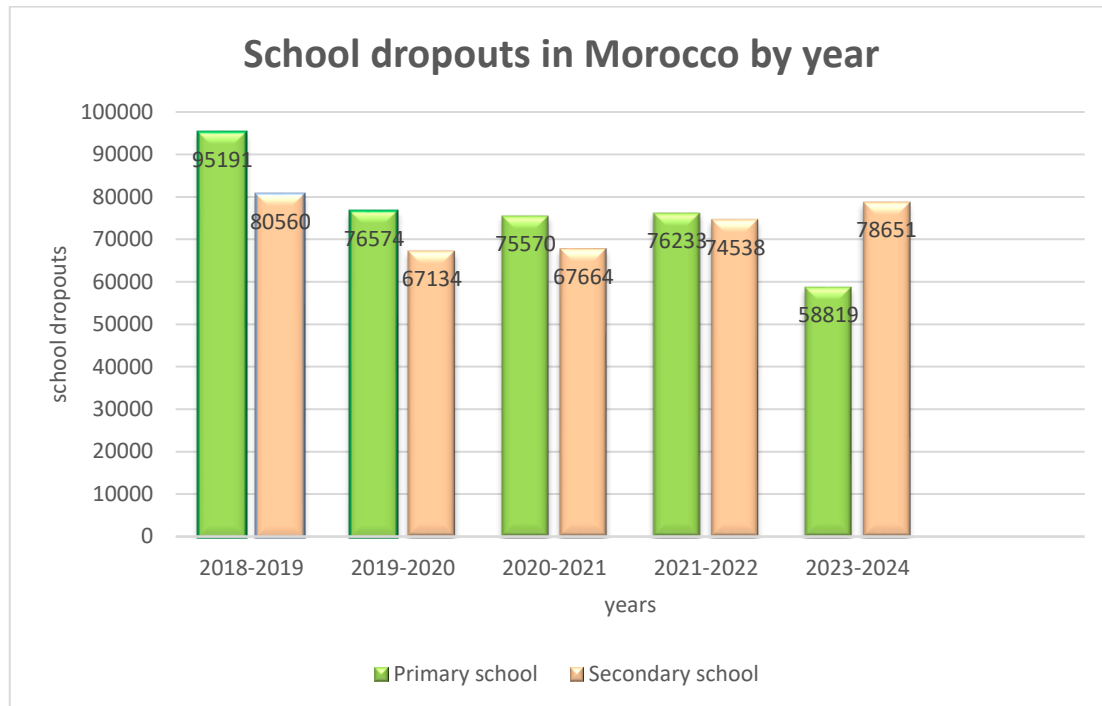
Figure 1. Representation of school dropouts in Morocco by year

A study on academic failure identified several main reasons for difficulties in succeeding in class [10], including:
−   Gaps in students' education and absence of corrective solutions.
−   Inappropriate school programs and evaluation systems (frequent and challenging changes).
−   Quality and attitudes of instructor (severity, lack of pedagogical skills, lack of conscientiousness).
−   Distance between school and home and lack of transportation.
−   Financial problems.
−   Frequent absences due to family or professional obligations.

In light of these challenges, reducing school drop-out rates is still a major issue in Morocco, where educational disparities remain between regions and socio-economic groups. To address this issue, many studies have been published highlighting the benefits of tutoring systems in the fight to prevent pupils dropping out of school. By giving individualized academic assistance, tutoring helps pupils to surmount the learning difficulties that often lead to early school leaving and disengagement [11]. Such programs are especially beneficial for learners with special needs and those from marginalized communities, as they address their specific educational issues. Current studies systematically confirm the positive impact of tutoring systems on improved student retention and academic success [12]. Along these lines, recent research has proven that students enrolled in after-school support programs make considerable academic progress and are significantly less likely to drop out before finishing school [13]. Similarly, the survey by [14] reported that remedial tutoring in Morocco significantly boosted the academic performance of students in rural areas, increasing retention rates. To improve tutoring and tutoring support, the Moroccan Ministry of Education has developed a vast e-learning platform called Massar [15], offer education professionals a range of services for monitoring students' learning and communicating with them online, however, the lack of effective implementation of this platform, due to students' lack of consciousness of the importance of the services it offers and insufficient training of learners and teachers on how to use it, has considerably reduced their access to the platform [16].

On the other hand, the educational support provided by teachers who use it is conventional, with similar exercises and teachings for all students, due to the lack of a pedagogical design strategy that takes into account the differentiation of learners' profiles [17]. In addition to the Massar platform, other educational support platforms have been set up by other volunteers. However, these have raised several issues in their use, mainly due to the lack of regular monitoring of learners and the voluntary nature of student access to these platforms [18]. These problems are compounded by other technical and pedagogical challenges, including moderate ease of use and navigation, some sites displaying commercial advertisements, as well as

undefined teaching strategies and the near absence of interactivity, as designers simply transfer textbook content to the internet. Furthermore, there is no feedback to correct students' mistakes [19]. All these issues have hindered the proper use of the proposed platforms and contributed to a disparity in the effectiveness of implementing the tutoring approach in Morocco. In light of this, we have chosen to conduct this research to address the following research questions:

– RQ1: What is the effective tutoring strategy that ensures the fight against school dropout on a national scale?
– RQ2: What are the essential requirements and design considerations for creating and implementing an effective tutoring system?

To answer these questions, we will provide, in the second section, a literature review on Moroccan tutoring strategies and the issues resulting from their implementation. In the third section, we will highlight the methodology adopted by exposing the algorithm along with its explanation. In the fourth section, we will present our proposed solution, which consists of a tutoring approach based on the strengths and weaknesses of the approaches already adopted, as well as a detailed technical study of the design of the digital system to be developed according to our proposed tutoring approach, including use cases and sequence diagrams for the various processes involved. In the fifth section, we will discuss the strengths of our proposal compared with existing systems, and we will conclude with a summary.

2.   LITERATURE REVIEW ON MOROCCAN TUTORING STRATEGIES
2.1. Individual tutoring

In Morocco, the educational system faces serious challenges such as crowded classrooms, inequality of access to quality education and the variety of student needs [20], which makes private tutoring a widely accepted practice among a growing number of students seeking personalized assistance outside the formal classroom environment [21]. Private tutoring can be delivered in various forms: individually, in small groups, or online [22]. Individual tutoring offers several advantages [23], including personalized instruction that takes into account each student's learning styles and academic challenges [24]. It enables tutors to give targeted support on specific topics or themes, helping students to improve their understanding and academic achievements [25]. In Morocco, the demand for individual tutoring has been driven by both academic and social factors. This method is particularly beneficial for students who may struggle to keep up with the regular curriculum or those who wish to deepen their knowledge in specific areas [26]. For students preparing for important exams, such as the baccalaureate, extra tutoring is often required to increase their chances of success [27].

However, despite the popularity of individual tutoring, its impact on the broader education system raises concerns. Critics argue that it reinforces educational inequality. Because of socio-economic disparities, one-to-one tutoring is not accessible to all students, and wealthier families are more apt to afford private tuition, bringing potential disparities in educational outcomes [28]. Moreover, the development of private tutoring has increased the use of supplementary education outside the formal school system, leading to questions about the role of traditional education in meeting the educational needs of all pupils [29]. Overall, individual tutoring in Morocco is a valuable educational tool, especially for those seeking to overcome academic challenges. However, the development of this approach underlines the need for a more effective and equitable education system, capable of offering quality learning experiences to all students, and reducing the need to rely on tutoring [30].

In response to this, the Moroccan Ministry of National Education has developed several online learning platforms, such as Massar, to enhance educational support and assist with tutoring. These platforms are designed to provide a variety of resources, including educational videos, exercises, and interactive materials, which are made available to students online [31]. Their goal is to complement traditional classroom learning and offer additional support to students, particularly those struggling with specific subjects or skills. However, although these platforms offer significant potential, they face several challenges that affect their overall effectiveness. One of the main issues is the voluntary nature of their access, meaning students may not feel compelled to use the platforms regularly [32]. As a result, in the absence of a structured system to encourage consistent engagement, many students are at risk of not fully benefiting from the resources available to them. Furthermore, the lack of structured supervision, such as a teacher or tutor to monitor their progress and provide guidance, makes it difficult to ensure that students are using the platforms effectively [33]. Moreover, the lack of pedagogical follow-up raises concerns about the quality and relevance of the educational content provided. Indeed, in the absence of professional guidance, there is a risk that the material may not align well with the curriculum or meet the diverse learning needs of all students. These factors collectively undermine the platforms' potential to provide effective remediation for students in need of additional tutoring support [34].

2.2. The challenges of the educational support strategies adopted in Morocco

Studies have identified several significant challenges within the Moroccan tutoring system. One of the major issues is the financial burden that private tutoring places on families, especially in the context of socio-economic disparities [35]. Many families struggle to afford private lessons, which exacerbates educational inequalities [36]. Moreover, tutoring websites, although accessible, often lack interactivity and do not provide adequate methodological support or feedback mechanisms, limiting their effectiveness in improving students' academic performance [37]. The platforms established by the Moroccan Ministry of National Education also face challenges [38], including the lack of training for educational stakeholders on how to use them, a lack of awareness about the services they offer and their importance [39], as well as the absence of effective systems to track students' progress or assess the success of the tutoring support [40].

These gaps hinder the potential of these platforms to provide meaningful tutoring support [41]. To address these issues, it is crucial to improve the existing tutoring infrastructure by adopting a more formalized individual tutoring approach based on students' portfolios to track their progress [42], and by introducing continuous assessment systems [43] before implementing remediation solutions. According to the authors [44], the development of career portfolios has two main objectives. First, it aims to improve the quality of learning by supporting and tracking educational progress [45]. Secondly, it promotes authentic self-assessment by learners [46], [47], which can enhance their understanding and self-confidence. The author in [48] explains that "the portfolio is reflective because it allows for a pause in evaluation. It provides delayed feedback, decisions made in the heat of the moment, as well as the contexts and actors involved in educational situations.

3. PROBLEMATIC

Despite the availability of various tutoring solutions, the Moroccan education system continues to struggle with high dropout rates and deep learning inequalities. To address this issue, the Ministry of National Education has implemented several digital teaching and remote monitoring platforms, the most significant of which is Massar. However, its voluntary use by students and teachers, combined with a lack of the necessary skills to fully leverage its services, limits its effectiveness. Moreover, the considerable workload imposed on teachers to design tutoring modules further complicates the adoption of this platform as a structured pedagogical support tool. Additionally, socio-economic disparities prevent a great number of students from accessing private tutoring, thereby exacerbating inequalities in the quality and equity of learning.

This paper addresses these challenges by proposing a structured, technology-driven tutoring system that integrates continuous assessment and personalized remediation on a national scale. This system also ensures the active involvement of teachers and administrators from the Ministry of National Education. Unlike existing solutions, the proposed system ensures systematic student engagement, real-time monitoring, and adaptive learning strategies tailored to the specific needs of each learner. By fully leveraging digital tools, this research aims to reduce educational disparities, curb school dropout rates, and provide more equitable learning opportunities for all Moroccan students.

4. METHODOLOGY

Our study is based on an analytical approach to design a new tutoring system that supports students in their academic journey. We have therefore examined in detail the theoretical models and proposals for tutoring systems already implemented, in order to identify their gaps and strengths, which will help us develop a new, effective system that ensures personalized support for students in their learning, according to their specific profiles. The methodology adopted in our study is qualitative, based on a conceptual modeling of the proposed information system through use case, activity, and sequence diagrams. In order to provide a comprehensive simulation and/or experimental setup for the proposed tutoring system, we have structured the process to ensure the system's effectiveness, adaptability, and reproducibility as shown in Figure 2. This setup outlines the necessary steps to replicate the experiment, enabling other researchers to easily recreate the setup and test the system in various educational contexts. The following paragraphs offer a detailed breakdown of the components involved in the experimental setup, focusing on the system's design, implementation, and evaluation.

4.1. Overview of tutoring system design

The tutoring system supports personalized student learning through structured phases as shown in Figure 3. It begins with an initialization phase, during which student accounts are created, followed by an assessment phase to identify learning difficulties. Next, the remediation phase targets students who have not mastered the assessed skills and require additional support. Finally, a reassessment phase measures progress

after remediation. Continuous feedback, recorded in students' assessment, learning, and presentation portfolios, keeps them engaged and informed of their progress, fostering their development. This systematic approach adapts teaching to individual needs, enhancing comprehension and skill acquisition. By addressing each learner's specific challenges, the system promotes academic success and boosts self-confidence, providing an adaptive learning experience for all participants.
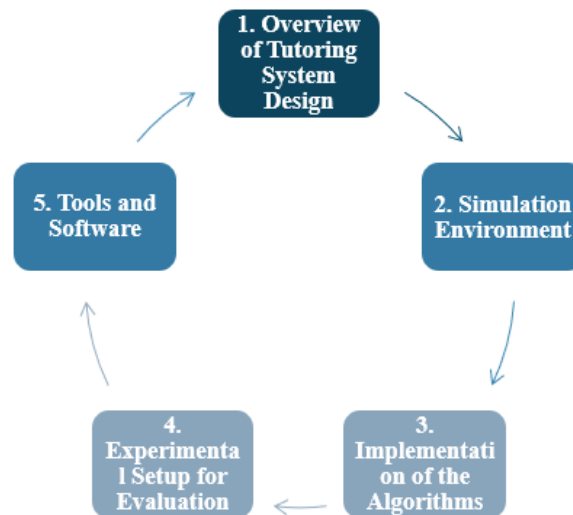

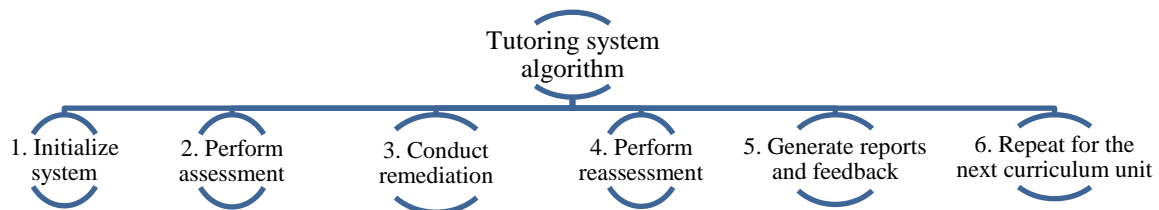Figure 2. Phases of experimental setup for the tutoring system

Figure 3. Phases of the tutoring system algorithm for evaluation and remediation

4.2. Simulation environment

In this phase of our project, we designed our tutoring system based on UML diagrams. We first used the class diagram to identify the main entities of the system, such as Student, Teacher, Inspector, and Administrator. Then, the activity diagram helped represent the flow of a tutoring session. Use case diagrams illustrated the different tasks associated with the system roles, while sequence diagrams detailed the interactions at each phase of a session. The complete design of our system is presented in Section 5.

4.3. Implementation of the algorithm

To operationalize the proposed tutoring system, we have implemented phases of the formal algorithm as shown in Figure 3, which outlines the key steps for evaluating student competencies, providing remediation, and tracking progress. Our algorithms are structured as follows:

a. Initialization: This phase sets up the tutoring system by creating and configuring student portfolios, which include personal information, learning preferences, and progress tracking. It also involves structuring and organizing curriculum units, ensuring that the necessary educational resources, learning objectives, and assessment criteria are properly defined and aligned with the system's instructional goals.

Algorithm 1. Initialization
```
1: Input: studentData, curriculumUnits, assessmentActivities, remediationActivities
2: Output: Initialized system with student portfolios
3: InitializeSystem()
```

```
4: for each student in studentData do
5 :    Create studentPortfolio
                6: end for
```

b. Assessment phase: students are evaluated based on predefined activities such as quizzes, assignments, or practical exercises. Their results are recorded and securely stored for further review. Students who meet the required criteria proceed, while those who fail are directed to a remediation process, where they receive additional support and resources to enhance their understanding before reassessment.

Algorithm 2. Assessment
```
1: Input: studentData, curriculumUnits, assessmentActivities
2: Output: Student performance evaluation stored in portfolio
3: for each curriculumUnit in curriculumUnits do
4:     for each student in studentData do
5:         NotifyStudent(student, "Assessment date for " + curriculumUnit)
6:         Results = EvaluateStudentPerformance(student, assessmentActivities)
7:         UpdatePortfolio(student, results, "assessment")
8:          if results indicate failure then
9:              Proceed to Remediation Phase
            10:          end if
            11:     end for
            12: end for
```

c. Remediation phase: In this phase, students who do not pass the assessments are given targeted remediation activities tailored to address their specific learning gaps. Their progress is continuously tracked and recorded in their learning portfolios to monitor improvements. Teachers actively provide feedback, guidance, and additional resources to support student learning. Once students demonstrate sufficient progress, reassessments are scheduled to evaluate their understanding and ensure readiness for the next stage.

Algorithm 3. Remediation
```
1: Input: Students who failed, remediationActivities, teacher feedback
2: Output: Updated student portfolio with remediation data
3: for each student who failed the assessment do
4:     NotifyStudent(student, "Remediation date for " + curriculumUnit)
5:     ProvideRemediation(student, remediationActivities)
6:     TeacherFeedback = ProvideFeedback(teacher, student, results)
7:     UpdatePortfolio(student, teacherFeedback, "learning")
8:     Schedule reassessment
                    9: end for
```

d. Reassessment phase: Students who complete the remediation process undergo a reassessment to evaluate their progress and understanding. If they successfully meet the required criteria, they proceed to the next stage of learning. However, if they fail again, they receive additional support, including personalized guidance, further remediation activities, and enhanced instructional resources to help them overcome their challenges before another reassessment is scheduled.

Algorithm 4. Reassessment
```
1: Input: Students who completed remediation, assessmentActivities
2: Output: Reassessed student results stored in portfolio
3: for each student who completed remediation do
4:     NotifyStudent(student, "Reassessment date for " + curriculumUnit)
5:     Results = ReassessStudent(student, assessmentActivities)
6:     UpdatePortfolio(student, results, "assessment")
7:     if results indicate failure then
8:         Repeat Remediation Phase or escalate to additional support
9:     end if
      10: end for
```

e. Reporting and feedback: In this phase, detailed progress reports are generated, summarizing student performance, assessment results, and areas of improvement. Based on these insights, personalized remediation recommendations are provided to guide students toward mastering the required concepts. Teachers and administrators use these reports to offer targeted feedback, adjust instructional strategies, and ensure that each student receives the necessary support to enhance their learning outcomes.

Algorithm 5. Reporting and feedback
```
1: Input: Student performance data
2: Output: Generated progress report and competency validation
```

```
3: for each student in studentData do
4:      StudentProgressReport = GenerateProgressReport(student)
5:      RemediationRecommendations = ProvideRemediation(student, remediationActivities)
6:      CompetencyValidation = UpdatePortfolio(student, results, "presentation")
                  7: end for
```

6. End of process: Upon completion of the current cycle, the process seamlessly transitions to the next curriculum unit, ensuring continuous evaluation, assessment, and support. This iterative approach allows students to progress through structured learning phases while receiving ongoing feedback, remediation, and reassessments as needed. By maintaining this cycle, the tutoring system fosters continuous improvement and mastery of concepts, adapting to each student's learning journey.

4.4. Experimental setup for evaluation

To assess the effectiveness of our system, we initially tested our platform in a classroom before expanding its deployment nationwide to refine its performance and identify key strengths. We then used various metrics related to student progress, including assessment results and remediation success, as well as system efficiency, such as progress tracking, adaptation to individual needs, and support for diverse learning profiles.

4.5. Tools and software

In this project, the tools and software used include Draw.io for designing detailed UML diagrams, Python as the primary programming language for system implementation, and structured databases for organizing, analyzing, and reporting data. These tools have facilitated efficient system design, development, and comprehensive data analysis throughout the project.

5. PROPOSED SOLUTION
5.1. Presentation of the suggested tutoring approach.

Based on the strengths and weaknesses identified in existing school support systems, we propose a solution to address the challenges of school dropout and learning difficulties. Our solution consists of a computerized school support system, providing continuous and personalized assistance to students to help them learn at their own pace and in their own style while overcoming economic, logistical, or geographical constraints. One of the key features of our computerized system is its participatory approach, which involves both administrators and teachers in the implementation of tutoring sessions [49]. This collaboration ensures that the system aligns with educational objectives and institutional needs. Regional education academy administrators oversee the implementation of this approach within the set deadlines, while teachers closely monitor the tutoring process, supporting students who have faced difficulties in acquiring academic skills during remediation sessions [50]. This enables effective and timely intervention. The system also integrates learner portfolios to facilitate the tracking of their academic progress while highlighting strengths and educational gaps that need to be addressed.

To implement our strategy, our digital platform offers students competency assessment activities at the end of educational units. If students fail to complete these activities successfully, it automatically indicates that they have not acquired the targeted competencies of the evaluated units. Consequently, remediation activities will be offered to them. The assessment and remediation activities should be designed and validated by a central entity composed of teachers and inspectors who collaborate in this process. The evaluation results and students' work will be recorded in their electronic portfolios.

5.2. Roles of the proposed system

The system involves several stakeholders in Figure 4, namely:
− Students: Their role is to interact with the system for learning, assessments, and remediation.
− Teachers: They are responsible for closely supervising the remediation process, providing corrective measures, giving feedback on students' progress, and proposing assessment and remediation activities to the committee.
− Inspectors: Their role is to oversee the implementation of the tutoring process to ensure it meets educational standards, as well as to propose assessment and remediation activities to the committee.
− Jury: He is responsible for validating the assessment and remediation activities.
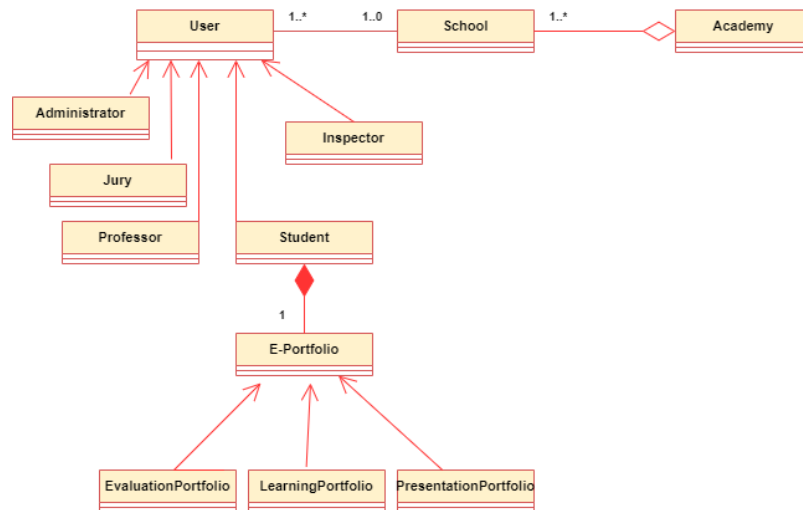− Administrator: Manages the technical issues of the system and the problems encountered by system users.

Figure 4. Role diagram in the system

5.3. Tutoring process according to the proposed approach

Our tutoring approach consists of three main components: a competency assessment interface, a remediation interface, and individual student portfolios. The assessment interface includes evaluation activities related to curriculum units that are part of the school programs. These assessment activities are developed by teachers and inspectors from the Ministry of National Education and validated by a central entity (committee) composed of subject inspectors designated by the ministry. Students create accounts to access the tutoring platform. They must authenticate themselves to access the assessment interface during the session set by the ministry and notified by the tutoring system at the end of a teaching unit or a remediation period. The students' work, as well as the results, including grades and comments, must be saved in the student's assessment portfolio to track their progress. If the student passes the assessment, the corresponding competency is validated and notified in their presentation e-portfolio. If the assessment is unsatisfactory, the student must complete the remediation activities recommended by the system and save their work in their learning portfolio for review by their subject teacher, who closely supervises the remediation process. At the end of the remediation session, the student will be reassessed to ensure their mastery of the previously failed competency. The tutoring process within the framework of this proposed system is illustrated in the activity diagram in Figure 5.
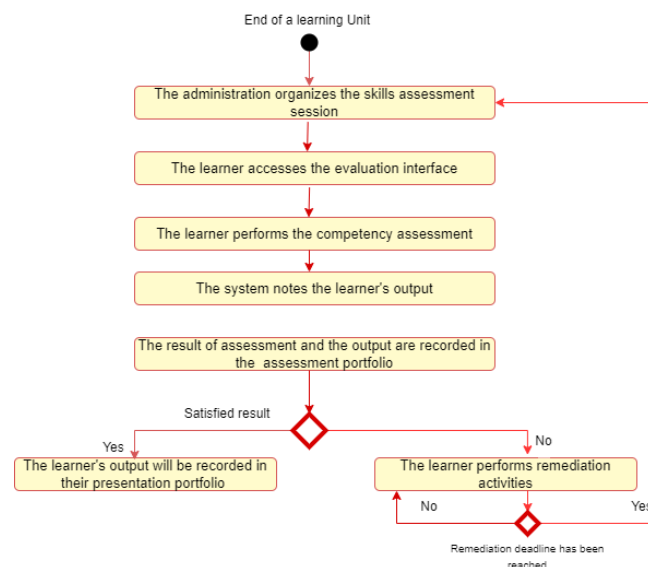

Figure 5. Activity diagram

5.4. Functionality of the suggested solution

In order to better understand the application and the interactions with the users, the authors proceed in this part to detail the main use case situations.

5.4.1. Administrator use case chart

The administrator has a crucial role on the platform, overseeing tasks such as creating accounts for students and teachers, managing the user database, updating records, handling all documentation, and addressing any reported issues. Access to the administration interface requires authentication by the administrator as illustrated in Figure 6.
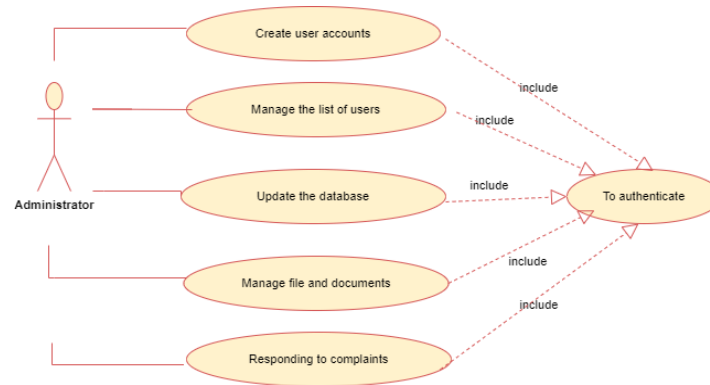
Figure 6. Administrator use case diagram

5.4.2. Use case diagram for students

The students are allowed to do the following, as illustrated in Figure 7:
–   Register on the online tutoring platform.
–   Modify their account passwords.
–   Update their e-portfolio profile by managing professional and personal information.
–   Visit the other exhibition portfolios.
–   Use the evaluation and remediation/teaching module.
–   Complete and submit assessments activities in their assessment portfolio.
–   Review their scores.
–   Review the questions with incorrect answers as well as the correct answers
–   Access remediation activities to address the gaps identified during the assessment
–   Finalize remediation activities and record them in their learning portfolios.
–   Review answer keys and receive feedback from teachers on remediation activities.
–   Report issues and communicate with peers and teachers through the discussion area.
–   Upload documents from the system.
–   Manage documents.
–   Comment on their electronic e-portfolios.

5.4.3. Teacher/inspector use case diagram

The effectiveness of the proposed system depends significantly on the active involvement of teachers. They can use the platform to perform the following steps, as illustrated in Figure 8:
–   Register and manage their account information.
–   Change their passwords.
–   Update their e-portfolio profiles with professional and personal information.
–   Consult and examine student portfolios.
–   Add commentary, feedback, guidelines and marks for students.
–   Access profiles of other teachers and inspectors.
–   Export and import files from and to the application.
–   Discuss with their colleagues on a forum reserved for teachers and inspectors in the same field.
–   Create assessment quizzes using the platform's questionnaire tool.

− Develop remedial activities.
− Collaborate with other educators and supervisors to design assessment and remediation activities using online tools.
− Submit the activities to the educational jury for validation.
− Register to become a jury member at regional or national level.
− Report any issues.
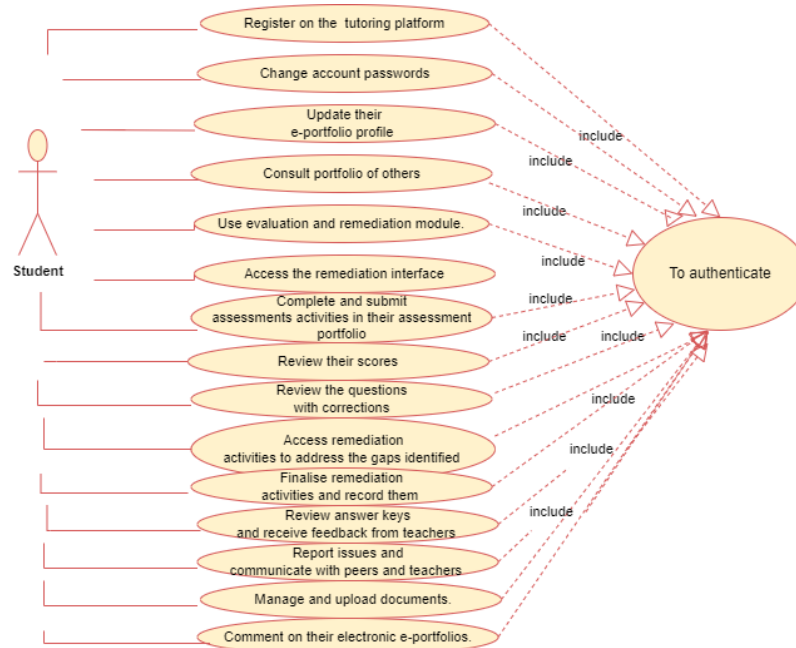− Examine the students' success rate and the causes of their failure.
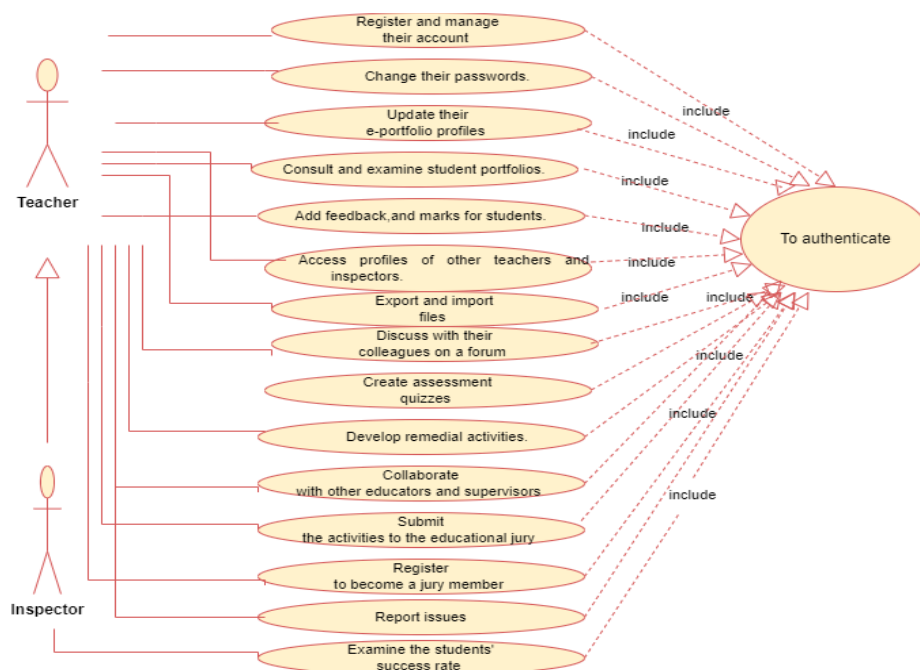

Figure 7. Student use case diagram

Figure 8. Teacher/inspector use case diagram

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5.4.4. Use case diagram for the jury

The jury is allowed to access the online platform to perform the following steps, as illustrated in Figure 9:
− Register and manage their account information.
− Provide feedback on assessment and remediation activities proposed by teachers and inspectors.
− Update assessment and remediation activities.
− Validate remediation and assessment activities.
− Submit these activities to the national jury for approval.
− Publish the activities once they have been approved by the national jury.
− Schedule the assessment dates.
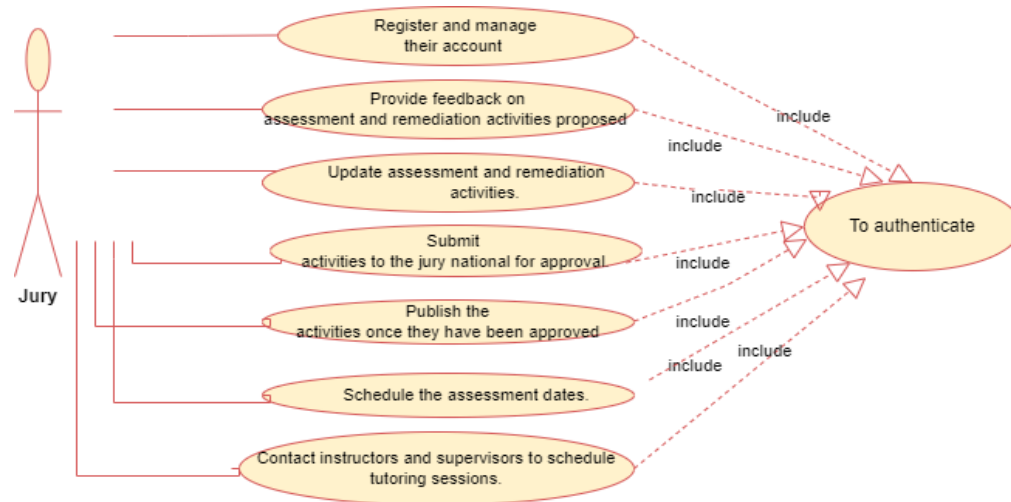− Contact instructors and supervisors to schedule tutoring sessions.

Figure 9. Jury use case diagram

5.4.5. Assessment sequence diagram

The evaluation process is carried out according to the following steps, as illustrated in Figure 10:
− The system informs the educational stakeholders (administrators, teachers, and students) of the assessment date for the acquisition of competencies in the target units, through an email that also provides direct links to the assessment activities.
− The students complete the assessment activities and submit the finished work.
− The system automatically evaluates the students' performance.
− The results and completed assessment activities are stored in the student's electronic assessment portfolio.
− The student's successful work, including the confirmation of competency acquisition, is added to the student's presentation portfolio.

5.4.6. Remediation sequence diagram

The remediation process follows these steps as shown in Figure 11:
− The system notifies students of the remedial date by sending them a message, including a personal link to the remedial activities.
− Pupils complete the remedial tasks and submit their finished work.
− The platform updates the student's learning e-portfolio with the completed remediation activities and results.
− Teacher or system evaluates the work of the student, provides feedback and engages in discussion with the student
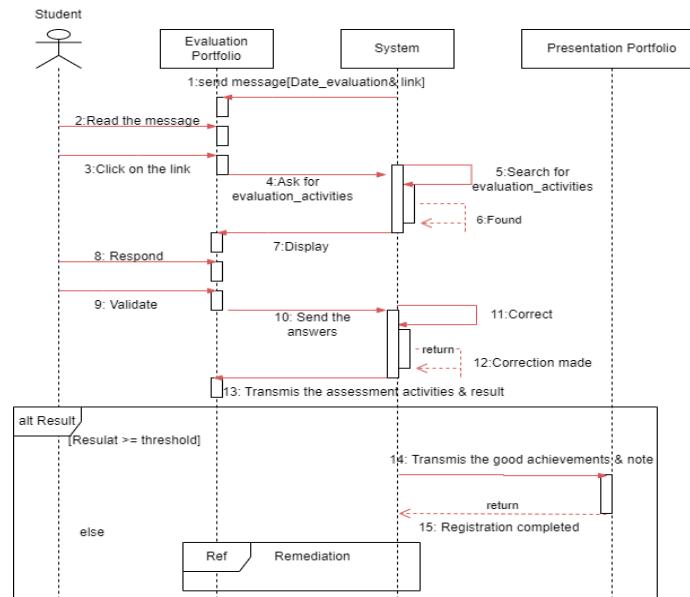− Once the remedial period is over, a notification is sent to the student.
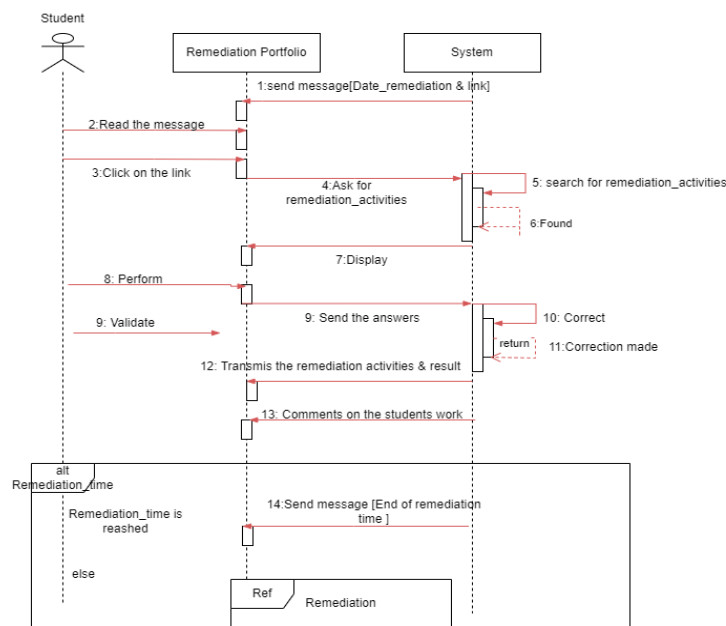
Figure 10. Assessment sequence diagram

Figure 11. Remediation sequence diagram

6.   RESULTS AND DISCUSSION

With a view to reducing the school dropout rate in Morocco, we propose in this article a participatory school support approach, involving all pedagogical actors - teachers and educational administrators - to ensure equity in the quality of student learning in primary and secondary education. Implementing this school support strategy on a national scale and within an official framework ensures: Firstly, that all parts of the school curriculum are completed within the officially set deadlines, thereby guaranteeing equity of education for all students. Secondly, we ensure that all students acquire the skills targeted in the curriculum. As a result, educators will be obliged to work harder to make the learning process a success. Thirdly, by providing such a high-quality tutoring system, it will be easy to detect students' shortcomings and fill them immediately; this will help eliminate the accumulation of didactic difficulties among students that contribute to the birth of didactic and epistemological obstacles hindering students' pursuit of their studies, leading consequently to their dropping out of school. Fourthly, by providing a free,

high-quality tutoring system, we relieve poor families of the need to pay large sums of money to provide their children with private tutoring to help them succeed in their studies, which helps to encourage their children to stay in school. Fifthly, the collaboration of teachers and inspectors in devising assessment and remedial activities tailored to typical student profiles by opting for differentiated pedagogy increases the effectiveness of the tutoring process. Briefly, Table 1 compares existing Moroccan online learning platforms Massar with our new tutoring system, focusing on engagement, supervision, curriculum alignment, and remediation effectiveness.

Table 1. Comparison table between Massar and the proposed system

Criteria	Existing platforms (Massar)	New tutoring system
Educational resources	Videos, exercises, and interactive materials	Structured lessons, AI-driven personalized exercises, and adaptive learning paths
Access	Voluntary, students decide when to use it	Systematic engagement with scheduled assessments and remediation
Student engagement	Low due to lack of obligation	High due to automated tracking and structured intervention
Teacher supervision	Limited or absent	Active teacher involvement with real-time feedback
Pedagogical follow-up	Weak, lacks structured monitoring	Strong, with continuous progress tracking and personalized remediation
Alignment with curriculum	Content may not always match students' needs	Fully aligned with national curriculum and student-specific learning gaps
Remediation support	Generic materials, no adaptive feedback	AI-based personalized remediation with reassessment phases
Effectiveness in reducing dropout rates	Limited impact due to inconsistent use	Higher impact due to structured evaluation and intervention

The implementation of this new tutoring system within an educational organization will allow for real-world testing, ensuring its effectiveness in improving student engagement, remediation, and overall learning success. The system will be integrated with existing platforms to provide structured supervision, personalized support, and adaptive learning, addressing current challenges in student retention and academic performance. Given the rapid advancements in AI and the emerging era of big data, which are driving the evolution of adaptive learning systems (ALS), our future research aims to enhance the system by harnessing these technologies to create a more responsive and data-driven approach. This will further refine the system's ability to personalize learning experiences, optimize student outcomes, and make real-time adjustments to meet individual needs. Through collaboration with educators and administrators, I aim to continuously improve the system and expand its application for broader impact in the educational sector.

7.   CONCLUSION

The following article presents a computerized tutoring solution based on a participatory approach between educational administrators and teachers, aimed at ensuring equitable, quality education on a national scale. We began by examining the different types of tutoring and highlighting the problems with the current tutoring strategy in Morocco. Next, we provided a detailed analysis of our system, which integrates student portfolios, covering the tutoring strategy used, new modeled learning and assessment processes, and an in-depth explanation of the system's functional behavior. On the basis of this information, future work will focus on improving the system's adaptability and scalability, ensuring the integration of real-time data analysis and AI-based feedback mechanisms such as assessment correction, prediction of student failure, selection of teaching activities adapted to each typical student profile, to better tailor tutoring experiences to individual student needs. Furthermore, by exploring these directions, we aim to ensure that the system remains effective, responsive and able to support diverse educational contexts across Morocco and beyond.

In addition to these improvements, future research will focus on expanding the scope of the tutoring system to different educational levels, including vocational training and higher education. The integration of machine learning models will further enhance predictive analytics, allowing for early intervention strategies that proactively support struggling students. Moreover, efforts will be directed towards developing a mobile-friendly version of the platform to increase accessibility, particularly for students in remote areas with limited access to traditional educational resources. Lastly, conducting large-scale pilot programs and collaborating with policymakers will be essential to refine the system's implementation, ensuring its alignment with national education policies and its scalability for widespread adoption.

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C	: **C**onceptualization	I	: **I**nvestigation	Vi	: **Vi**sualization
M	: **M**ethodology	R	: **R**esources	Su	: **Su**pervision
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CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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