

Assessing the Performance of Moroccan Secondary Schools Using Value-Added Indicators (VAIs): A Case Study of the Tangier–Assilah Provincial Directorate

Évaluation de la performance des établissements d'enseignement secondaire marocains à l'aide des indicateurs de valeur ajoutée (IVA) : le cas de la Direction provinciale de Tanger-Assilah

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ABSTRACT

The purpose of this article is to evaluate the performance of Moroccan high schools using value-added indicators (VAIs), in order to overcome the limitations of traditional performance measures and provide a fairer assessment that takes into account students' initial characteristics. The study highlights the relevance of value-added indicators as a more appropriate tool for evaluating school performance, drawing on data from high schools under the Tanger-Assilah Provincial Directorate. It proposes a two-dimensional value-added model adapted to the Moroccan context, based on value-added for graduation (VA-graduation) and value-added for distinction (VA-distinction). It also compares traditional school rankings with those derived from value-added indicators and introduces a typology of high schools based on the combined analysis of these two indicators. The results show that value-added indicators make it possible to distinguish the performance genuinely attributable to schools' educational contribution from that explained by students' initial characteristics, thereby providing a fairer and more accurate assessment of school performance.

Keywords : Value-added indicators ; School performance ; High school evaluation ; Educational equity ; Morocco ; Tanger-Assilah.

RESUME

L'objet de cet article est d'évaluer la performance des lycées marocains à travers les indicateurs de valeur ajoutée, afin de dépasser les limites des mesures traditionnelles et de proposer une évaluation plus équitable tenant compte des caractéristiques initiales des élèves.

L'étude met en évidence l'intérêt des indicateurs de valeur ajoutée (IVA) comme outil d'évaluation plus pertinent, en s'appuyant sur les données des lycées de la Direction provinciale de Tanger-Assilah. Elle propose un modèle bidimensionnel de valeur ajoutée adapté au contexte marocain, fondé sur la valeur ajoutée de la réussite (VA-réussite) et la valeur ajoutée des mentions (VA-mention), ainsi qu'une comparaison entre les classements traditionnels des établissements et ceux obtenus à partir des indicateurs de valeur ajoutée. Elle introduit également une typologie des lycées issue du croisement de ces deux indicateurs. Les résultats montrent que les IVA permettent de distinguer la performance réellement imputable à l'action pédagogique des établissements de celle liée aux caractéristiques initiales des élèves, offrant ainsi une évaluation plus juste et plus précise de la performance scolaire.

Mots clés : Indicateurs de valeur ajoutée ; Performance scolaire ; Évaluation des lycées ; Équité éducative ; Maroc ; Tanger-Assilah.

INTRODUCTION

In a global context shaped by New Public Management (NPM), education systems are increasingly expected to improve their performance, transparency, and accountability. Since its emergence in the 1980s, NPM has promoted a results-oriented approach to public management, encouraging the use of performance measurement, evaluation, and evidence-based decision-making. Within education, these developments have transformed the governance of schools, which are now expected not only to provide equitable access to education but also to demonstrate their effectiveness through measurable and comparable outcomes.

In Morocco, these international trends have been reflected in successive educational reforms aimed at improving the quality, equity, and efficiency of the education system. The Strategic Vision 2015–2030 and the recommendations of the New Development Model (2021–2035) both emphasize the importance of establishing transparent and rigorous mechanisms for monitoring and evaluating school performance in order to support continuous improvement and informed educational policymaking. Despite these reforms, evaluating the performance of Moroccan secondary schools remains methodologically challenging. Traditional performance indicators, such as examination pass rates or distinction rates, provide only a partial picture of school effectiveness because they do not account for differences in students' initial academic achievement or socioeconomic backgrounds. Consequently, schools enrolling more advantaged students may appear to perform better regardless of their actual educational contribution. To address this limitation, value-added indicators (VAIs) have been developed to estimate the specific contribution of schools by comparing students' observed outcomes with those expected on the basis of their initial characteristics.

Although value-added indicators (VAIs) are now well established in both Anglo-Saxon and French education systems—where they notably underpin the Indicateurs de Valeur Ajoutée des Lycées (IVAL), published annually by the French Ministry of National Education—their application to the Moroccan context remains largely unexplored. Existing studies, particularly those by Benjilali and colleagues, have made important contributions to the evaluation of school performance in Morocco. However, they generally rely on a single value-added measure based solely on examination pass rates, thereby assessing school performance exclusively from a quantitative perspective—namely, maximizing the proportion of students who pass the examination—while overlooking its qualitative dimension.

In this perspective, the present study proposes a bidimensional value-added framework that conceptualizes school performance through two complementary dimensions. The first, **Value-**

Added for Success (VA-Success), measures the school's contribution to students' probability of passing the final examination after controlling for their prior attainment. It therefore reflects the school's contribution to the democratization of educational success. The second, **Value-Added for Excellence (VA-Distinction)**, measures the school's contribution to students' probability of obtaining academic distinctions (Fairly Good, Good, and Very Good), again after controlling for their prior attainment. Unlike previous approaches, this indicator captures educational excellence as an independent dimension of school performance rather than as a simple consequence of examination success. The combined use of these two indicators provides a more comprehensive assessment of school effectiveness by simultaneously considering schools' capacity to promote broad student success and to foster high academic achievement. Accordingly, this study makes three main contributions :

- **Methodologically**, it develops a bidimensional value-added model adapted to the Moroccan educational context and introduces a typology of secondary schools based on the combined analysis of VA-Success and VA-Distinction.
- **Empirically**, the proposed framework is applied to public secondary schools in the Tangier–Assilah Provincial Directorate and the resulting rankings are compared with those obtained from traditional performance indicators.
- **Theoretically**, the study proposes an integrated framework combining insights from New Public Management, Accountability Theory, Public Value Theory, and Performance Management Systems while extending conventional value-added models through the explicit incorporation of educational excellence.

Overall, this research goes beyond adapting an existing methodology to the Moroccan context. It proposes a multidimensional and fairer approach to school performance evaluation that better reflects schools' actual educational contribution while reducing the influence of students' initial social and academic characteristics.

Against this background, the central research question is the following:

To what extent does a value-added model integrating both the democratization of educational success and educational excellence provide a fairer, more comprehensive, and more relevant measure of the performance of Moroccan secondary schools than traditional evaluation approaches?

To answer this question, the study aims to examine the relevance and applicability of two complementary value-added indicators—VA-Success and VA-Distinction—in evaluating Moroccan secondary schools. More specifically, it seeks to:

- develop a conceptual and methodological framework for constructing these indicators within the Moroccan context;
- classify schools according to their combined performance in promoting both educational success and excellence;
- compare the results obtained from this multidimensional approach with those generated by conventional performance indicators.

The significance of this study is twofold.

- From a **scientific perspective**, it seeks to address a gap in the Moroccan literature by adapting internationally recognized school evaluation tools to the national context. It also extends previous research by introducing a distinct dimension of educational excellence through **Value-Added for Excellence (VA-Distinction)** and by proposing a cross-classification of schools based on the joint analysis of the two value-added indicators.
- From a **practical perspective**, the study aims to provide policymakers with a fairer and more discriminating evaluation tool to support educational policymaking and improve school performance management. Specifically, it enables the identification not only of schools that successfully promote student achievement (democratization), but also of those that genuinely enhance students' academic performance and foster educational excellence.

1. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

1.1. DEFINITION OF ADDED VALUE

Educational assessment literature identifies three main complementary approaches:

- **Institutional** (Ministry of National Education –France): Value added corresponds to the difference between observed and expected results, taking into account the initial characteristics of the students. It aims to measure the specific effect of the institution.
 - **Academic** (Suchaut, IREDU–France): VA is an indicator of effectiveness that neutralizes initial differences between students to assess the actual contribution of the school.
 - **International** (Jesson & Gray – United Kingdom): VA measures student progress between two school stages, highlighting the role of the school in this development.
- In short, academic VA measures the specific effect of an institution on the progress of its students. It corresponds to the gap between the results obtained and those expected based on their initial knowledge and characteristics (academic level, social background, context).

This indicator of educational effectiveness allows for a fair comparison of institutions by limiting the influence of social or academic inequalities.

1.2. THEORETICAL FOUNDATIONS OF VALUE ADDED (VA) IN EDUCATION

VA is based on several approaches :

- **Economics of educational production :** The school is considered a production function that transforms inputs (initial level of students, teachers, resources) into outputs (learning, skills). VA measures the specific effect of the institution, controlling for initial characteristics, using econometric models .

- **Human capital theory:** Education is an investment that increases skills, productivity, and future income. VA assesses the ability of schools to strengthen the human capital of their students, with an impact on overall economic and social development.

- **Educational justice and equal opportunity:** VA identifies schools that help reduce educational inequalities by neutralizing the effects of students' social background and initial achievement, thereby highlighting institutions that genuinely promote equity

- **New Public Management (NPM):** VA is a tool for measuring performance and accountability, aligned with NPM principles (efficiency, results orientation, transparency). It promotes accountability, comparison between institutions, and optimal resource allocation.

- **Accountability Theory:** From an accountability perspective, schools are expected to demonstrate and justify their educational performance to governments, parents, and society. Value-added indicators provide a fairer basis for accountability than raw examination results because they distinguish the school's actual contribution from the influence of students' socioeconomic background. Consequently, VA promotes responsible performance evaluation while avoiding unfair comparisons between schools serving different student populations.

- **Public Value Theory:** Public Value Theory argues that the performance of public organizations should be assessed according to the value they create for society rather than solely through efficiency indicators. In education, this public value includes academic achievement, equity, social inclusion, and excellence. Value-added models support this perspective by evaluating schools according to the educational value they generate. In the present study, this approach is extended through a two-dimensional model that simultaneously measures value added in graduation rates (democratization of success) and value added in honours rates (academic excellence).

- **Performance Management Systems (PMS):** Performance Management Systems emphasize the use of comprehensive performance indicators to monitor organizational

effectiveness, support strategic decision-making, and foster continuous improvement. Within this framework, value-added indicators constitute management tools that enable educational authorities to identify high-performing schools, detect areas requiring intervention, and guide policy decisions. The proposed multidimensional VA model strengthens this function by combining complementary indicators of effectiveness and excellence.

□ **Public Governance Theory:** Public Governance Theory extends the traditional managerial perspective by emphasizing transparency, stakeholder involvement, evidence-based policymaking, and collaborative governance. Value-added indicators contribute to these objectives by providing reliable and equitable information on school performance. They support more informed educational governance, improve strategic planning, and facilitate policy decisions aimed at enhancing both quality and equity within the education system.

1.3. PREVIOUS EMPIRICAL STUDIES

Internationally, VA has been used for several decades. In the United Kingdom, VA measures have been integrated into official statistics since the late 1990s. In the United States, VA models are employed in various states, particularly to evaluate teachers and schools. In France, VAI s have been published annually by the Ministry of National Education since 1993. The table below presents, in chronological order, the main empirical studies dedicated to value-added indicators of schools.

Table 1 : Major Authors and Conclusions on the Use of Value-Added Indicators in Educational Evaluation

Authors	Year / Country	Conclusion on ADDED VALUE
Ministry of National Education – DEPP	Since 1980 – France	VA is a net indicator of the school, neutralizing social effects.
David Jesson & John Gray	1991 – UK	VA must integrate initial level to compare schools fairly.
Bernard Suchaut – IREDU	2000 – France	VA shows persistent gaps despite adjustments, suggesting the role of pedagogical factors.
Julian Betts & James Shkolnik	2000 – USA	VA isolates the specific contribution of schools.
Abi-Saab & Alt – UNESCO	2001 – France	VA is a strategic management tool with adjusted indicators.
Leslie Saunders	2001 – UK	VA is useful but must be interpreted cautiously depending on context.
Brien & Page	2005 – USA	VA mainly reflects the profiles of enrolled students.
Hanushek & Rivkin	2006/2010 – USA/OECD	VA reflects real effectiveness if composition effects are well controlled.

Piketty & Valdenaire – DEPP	2006 – France	VA is an equity instrument, correcting social biases.
Douglas Harris	2006 – USA	VA shows strong variations linked to local practices.
Lubienski & Lubienski	2006 – USA	VA strongly depends on structural and social context.
Jörn-Steffen Pischke	2007 – Germany	VA measures net contribution after neutralizing family background.
Ladd, Bifulco & Ross	2008 – UK/USA	VA is unstable across cohorts but useful for tracking trends.
Le Grand, Beaud, Baudelot et al.	2010 – France	VA isolates the net impact of schools after controlling for social background.
Baillat, Cros & Demeuse	2010 – France	VA is a pedagogical management tool for educational practices.
Van de Walle & Van Damme	2010 – Belgium	VA distinguishes specific effectiveness by neutralizing social influence.
Gibbons & Silva	2011 – UK	VA accurately measures the net impact of schools.
Hoening, Mons & Pons	2012 – France	Individually adjusted VA reinforces the equity of comparisons.
Feyisa Demie	2013 – UK	VA is a robust tool for monitoring educational inequalities.
Bartels & Dronkers	2014 – Netherlands	VA highlights the net effect of schools, useful for international comparisons.
Stéphane Levaï	2014 – France	VA is relevant but requires reliable longitudinal tracking.
Burgess, Wilson & Worth	2014 – UK	VA differentiates schools, but its interpretation depends on context.
Ehlert, Maaz, Neumann & Meyer	2016 – Germany	VA is influenced by school selectivity, limiting the share attributable to teaching practices.
Benjilali, Chikhi, Hammou & Esegbir	2017/2018 – Morocco	VA identifies the net effectiveness of secondary schools and serves as a strategic educational management tool.
DEPP (VAIS / Open Data)	2024 – France	VA is updated as an indicator of net pedagogical action and used for public management.

Source: Author

1.4. PRESENTATION OF THE VAIS METHODOLOGY

1.4.1. DEFINITION OF VAIS

The Indicators of Added Value in Secondary schools (**VAIs**) are a set of statistical tools that measure the real impact of a school on the success of its students. Unlike raw indicators, they neutralize the effects of students' initial profiles (level, age, gender, social background) and the high school context. They are calculated by comparing observed results (high school graduation rates, academic performance) with expected results based on statistical models (regressions,

logit, multilevel). The difference obtained is the added value, either positive or negative. VAIs make it possible to:

- inform the public and families about the contextualized performance of schools,
- guide educational and institutional decisions,
- support teams in adjusting their practices,
- empower stakeholders through evaluation and accountability.

1.4.2. VAIS METHODOLOGY

Measuring school performance using the value-added approach involves constructing a set of indicators as follows:

Indicators	Definition	Formula
Observed Success Rate	Relates the number of high school students who passed the baccalaureate to the number of students who sat for the exam.	$= \frac{\text{Graduates (Baccalaureate Holders)}}{\text{Attendees}} \times 100$
Observed Access Rate	Relates students who progressed to the next grade level to those present the previous year in the lower grade, subtracting repeaters.	$= \frac{\text{Successes}}{\text{Attendees} - \text{Repeaters}} \times 100$
Observed Distinction Rate	Percentage of students who obtained distinction: satisfactory, good, very good, among those who took the exam.	$= \frac{\text{Graduates with distinction}}{\text{Attendees}} \times 100$
Expected Rates	Estimated from a multi-level econometric model: probability of success, progression to the next grade, or obtaining distinction, according to student and school characteristics.	Expected Rates = Simulation by econometric model
Value Added	Difference between the school's observed rate and its expected rate, for each indicator (success, access, distinction).	Value Added = Observed Rate – Expected Rate

Source: Author

2. CONSTRUCTING VALUE-ADDED INDICATORS (VAIS) TO MEASURE PERFORMANCE IN VOCATIONAL SECONDARY SCHOOLS WITHIN THE TANGIER PROVINCIAL DIRECTORATE

2.1. DATA SOURCES AND VARIABLES

The scope of our research is limited to the Tangier-Assilah Regional Directorate of Education and Training for the 2023-2024 school year. We were able to obtain data on 27 public secondary

schools with 4988 students in the second year of the baccalaureate from the Provincial Directorate of the Ministry of National Education in Tangier. This data covers:

- **Baccalaureate results** (admitted, not admitted, distinction).
- **Individual student information** : age, gender, academic delay, middle school of origin, average grade in 9th grade .
- **Contextual data:** social and academic characteristics of schools (proportion of students in academic delay, average entry level, social composition)

2.2. DESCRIPTIVE ANALYSIS

2.2.1. DESCRIPTIVE ANALYSIS

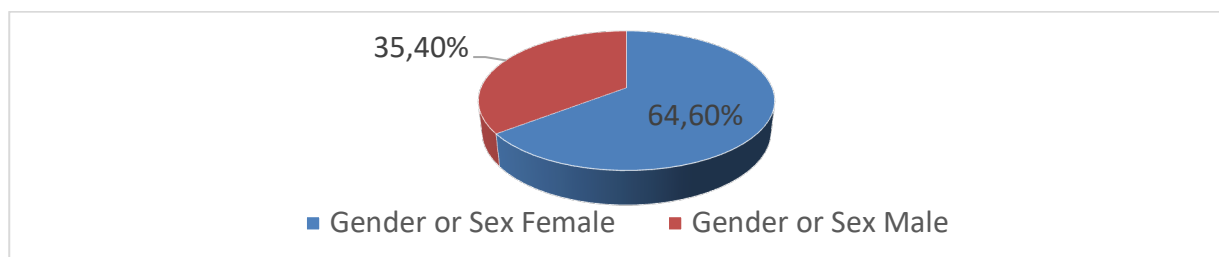
Table 2: Distribution of students in the sample according to individual characteristics

Gender or Sex		Parents' Category	Socio-professional		Academic Delay		Grade in 3rd Year of Middle School		
Female	Male	Disadvantaged	Middle	Favorable to Very Favorable	No Delay	With Delay	Less than 10	Between 10 and 14	More than 14
64,60%	35,40%	27,95%	60,87%	11,19%	82,06%	17,94%	0,10%	64,01%	35,89%

Source: Author

This table reveals:

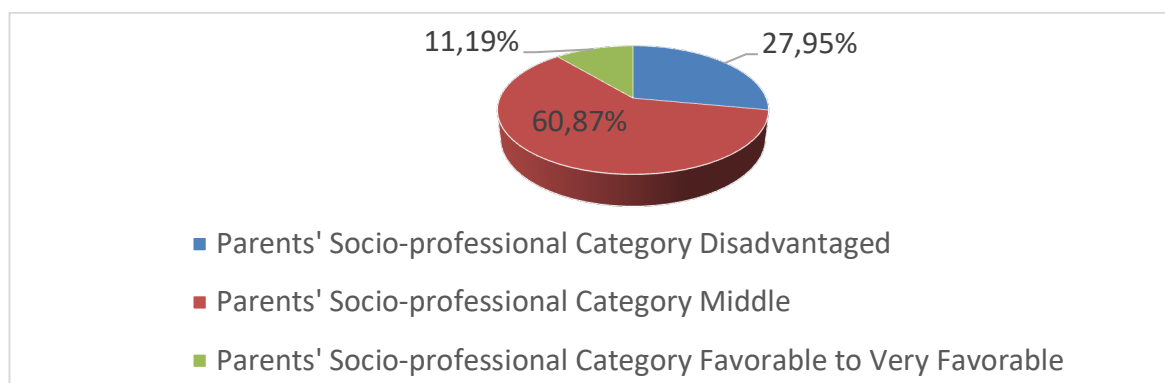
Figure 1: Distribution of students in the sample by gender



Source: Author

- **Female predominance** : 64.60% of the sample are girls, while boys represent only 35.40%.

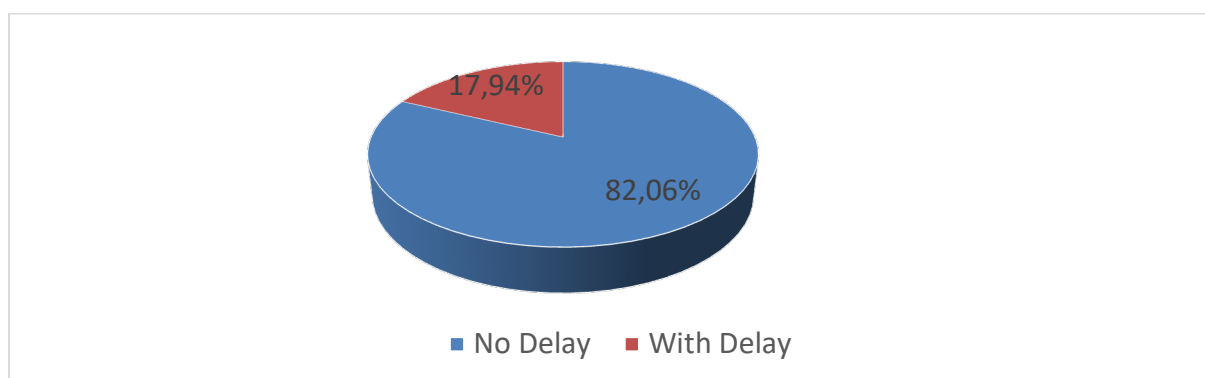
Figure 2: Distribution of students in the sample according to their parents' socio-professional categories



Source: Author

- **Mostly middle-class socioeconomic background:** The majority of students come from families with middle-class socioeconomic status (60.87%), while 27.95% come from disadvantaged backgrounds and only 11.19% come from privileged or very privileged families.

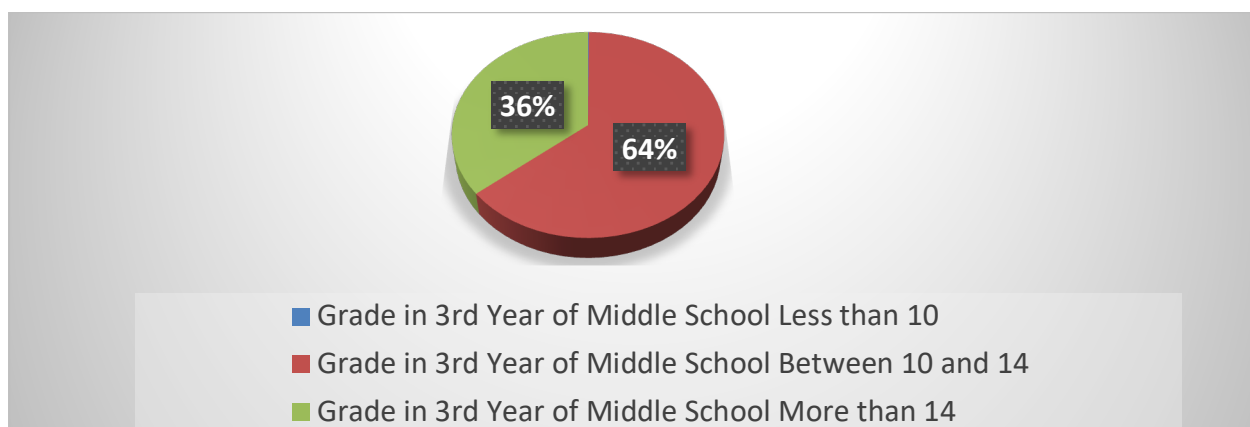
Figure 3: Distribution of students in the sample according to the presence or absence of academic delay



Source: Author

- **Low rate of academic delay:** The majority of students (82.06%) have no academic delay, compared to only 17.94% who do.

Figure 4: Distribution of students in the sample according to their average grade in the third year of middle school (grade in the third year of middle school)



Source: Author

- **Predominance of students who obtained an average score between 10 and 14 at the end of middle school:** The majority (64.01%) had an average score between 10 and 14, while a significant group (35.89%) even achieved excellent results with scores above 14. It should be noted that only a tiny fraction (0.10%) had a grade below 10.

2.2.2. THE COMPOSITION OF VOCATIONAL SECONDARY SCHOOLS BASED ON INDIVIDUAL VARIABLES OF SECOND-YEAR BACCALAUREATE STUDENTS

**Table 3 : The composition of vocational secondary schools based on individual variables
of second-year baccalaureate students (in %)**

School	Gender or Sex		Parents' Socio-professional Category			Academic Delay		Grade in 3rd Year of Middle School		
	Female	Male	Disadvantaged	Middle	Favorable to Very Favorable	No Delay	With Delay	Between 10 and 14	Less than 10	More than 14
Al-Karkarat	65,8	34,2	36,8	63,2	0,0	63,2	36,8	92,1	2,6	5,3
Abou Al-Abbas Sebti	65,2	34,8	15,7	67,7	16,6	87,1	12,9	57,5	0,0	42,5
Abou Bakr Errazi	60,3	39,7	29,4	54,4	16,3	85,3	14,7	60,3	0,0	39,7
Ibn Al-Khatib	54,4	45,7	36,4	47,3	16,3	78,3	21,7	75,0	0,0	25,0
Ibn Battouta	61,0	39,0	14,9	56,0	29,1	96,5	3,6	14,9	0,0	85,1
Al-Ghazali	63,3	36,7	15,8	77,6	6,6	88,3	11,7	61,2	0,0	38,8
Al-Jamaï	68,5	31,5	38,7	50,3	11,1	84,5	15,5	69,1	0,0	30,9
Al-Hansali	67,8	32,2	23,9	68,7	7,4	78,3	21,7	75,7	0,0	24,4
Al-Khawarizmi	69,6	30,4	29,0	69,2	1,8	71,4	28,6	84,8	0,0	15,2
Al-Mourabitine	70,2	29,8	50,0	46,5	3,5	88,6	11,4	68,4	0,0	31,6
Al-Mahdi El-Manjra	68,3	31,7	29,7	66,3	4,0	75,7	24,3	75,3	0,0	24,8
Bir Anzarane	68,6	31,4	20,9	59,8	19,3	82,9	17,2	59,0	0,0	41,0
Zineb An-Nafzaouia	63,6	36,4	36,4	59,1	4,6	80,3	19,7	81,8	0,0	18,2
Sidi Idriss	71,6	28,4	29,7	55,5	14,8	85,2	14,8	52,9	0,0	47,1
Abdelkhalek Torres	57,3	42,8	18,3	53,4	28,2	94,7	5,3	30,5	0,0	69,5
Abdellah Chafchaoui	66,0	34,0	39,7	58,3	2,0	74,9	25,1	74,9	0,8	24,3
Abdelmoumen Almohadi	61,7	38,3	40,7	53,3	6,1	76,2	23,8	83,2	0,0	16,8
Allal El Fassi	63,6	36,4	29,4	61,0	9,6	87,6	12,4	62,4	0,0	37,6
Mohamed Errekraqi	71,6	28,4	22,3	76,7	0,9	67,0	33,0	86,1	0,0	14,0
Mohamed El Ouafa	83,3	16,7	57,4	40,7	1,9	88,9	11,1	64,8	0,0	35,2
M Abdelkrim El Khattabi	71,4	28,6	32,4	60,5	7,1	76,7	23,3	84,3	0,5	15,2
Moulay Rachid	65,3	34,7	22,5	67,6	9,8	83,2	16,8	68,8	0,0	31,2
Moulay Ali Cherif	62,1	37,9	34,7	60,5	4,8	71,8	28,2	75,8	0,0	24,2
Moulay Youssef	46,6	53,4	25,4	41,4	33,2	96,4	3,6	12,7	0,0	87,3
Oued Eddahab	62,5	37,5	12,5	77,4	10,1	73,8	26,2	57,1	0,6	42,3
Ibn Zohr	69,0	31,0	25,5	69,7	4,8	80,7	19,3	67,6	0,0	32,4
Al-Bassatine	68,0	32,0	31,1	66,0	2,9	82,5	17,5	75,7	0,0	24,3
TOTAL	64,6	35,4	28,0	60,9	11,2	82,1	17,9	64,0	0,1	35,9

Source: Author

The table highlights several major trends:

- **Gender:** girls are in the majority in most secondary schools, with some exceeding 70%.
- **Social background:** there are significant disparities between schools, with some secondary schools having a majority of disadvantaged students and others having a majority of students from middle-class or privileged backgrounds.
- **Academic delay:** the proportion of students without academic delay is high overall (82.06%), but varies greatly between secondary schools. Some schools have very low rates (Ibn Battouta 3.55%, Moulay Youssef 3.58%, Abdelkhalek Torres 5.34%), while others exceed 20% (Al-Karkarat 36.84%, Mohamed Errekraqi 33.02%, Al-Khawarizmi 28.57%).
- **Academic level at the end of the third year of middle school:** marked differences between secondary schools. The majority of students (64.01%) have an average grade of 10 to 14, with higher concentrations in certain schools (Al-Karkarat 92.11%, Allal El Fassi 62.44%, Ibn Zohr 67.59%). Some secondary schools stand out for their academic excellence (Moulay Youssef, Ibn Battouta).

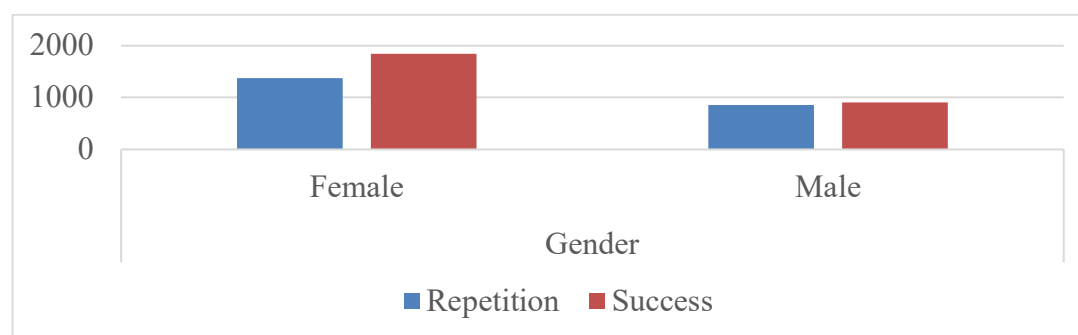
2.2.3. DESCRIPTIVE AND ANALYTICAL STUDY OF STUDENT RESULTS

Table 4 : Distribution of success according to individual and social factors

Result	Gender		Academic Delay		Grade in 3rd Year of Middle School			Parents' Category	Socio-professional	
	Female	Male	No Delay	With Delay	Between 10 and 14	Less than 10	More than 14	Disadvantaged	Middle	Favorable to Very Favorable
Repetition	1374	861	512	1723	1892	1	342	655	1404	176
Success	1848	905	383	2370	1301	4	1448	739	1632	382

Source: Author

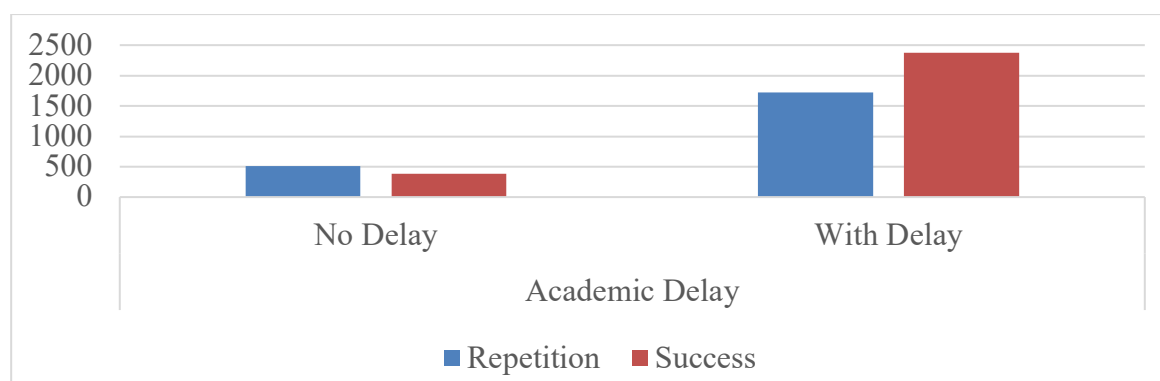
Figure 5 : Percentage distribution of success in the baccalauréat by sex



Source: Author

- **Higher success rate among girls:** 67.13% of girls compared to 32.87% of males.

Figure 6 : Percentage distribution of success rate in the baccalauréat by academic Delay



Source : Author

- **The success rate is higher for students without academic delay**, with 86.09% succeeding compared to only 13.91% for those with a delay.

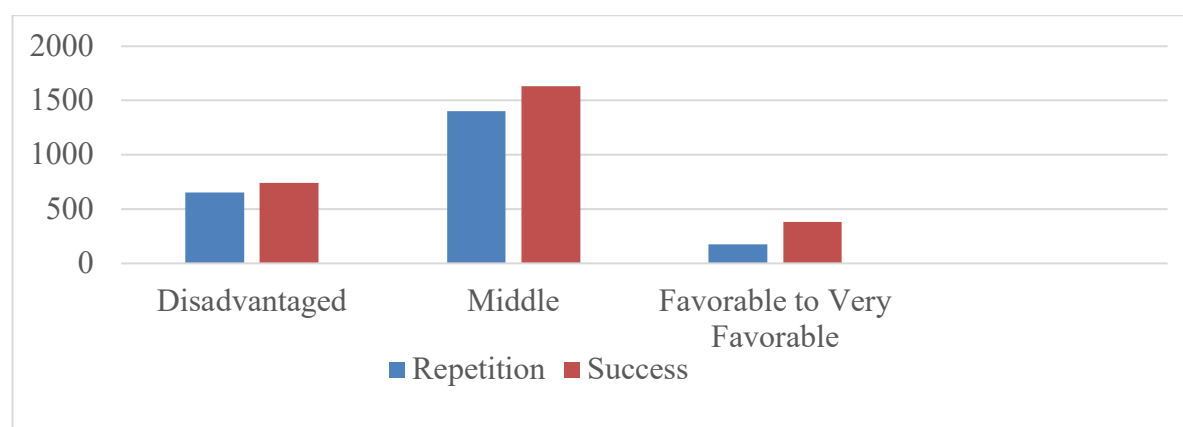
Figure 7 : Percentage distribution of success in the baccalauréat by Grade in 3rd Year of Middle School



Source : Author

- **Students with a grade higher than 14 are the most successful**, with a 52.60% success rate compared to 47.26% for those with a grade between 10 and 14.

Figure 8 : Percentage distribution of success and repetition in the baccalauréat by parents' socio-professional category



Source: Author

- **Students from favorable backgrounds (68.5%) have a clear advantage**, but middle-class and disadvantaged students succeed at almost identical rates (53%).

2.3. MODEL ESTIMATION

2.3.1. MULTILEVEL MODEL SPECIFICATION

The calculation of expected rates is based on a statistical model applied to each high school. It simulates, for each student, their probability of obtaining a high school diploma, advancing to higher education, or obtaining distinction, based on their individual characteristics (age, academic level at the start of 10th grade, social background, and gender) as well as the characteristics of the high school they attend.

The probability associated with each student is estimated on the basis that they are enrolled in a school that contributes neither more nor less than the average school to the academic success of its students.

The models used in the VAIS are multilevel random effects models with the following form:

$$\text{logit}(P_{ij}) = \beta X_{ij} + \gamma Z_j + \theta X_j + \alpha_j + e_{ij}$$

This type of model allows not only individual characteristics to be taken into account, but also contextual variables. The latter characterize an environment shared by several individuals. Here:

- P_{ij} is the probability of student i succeeding in school j ;
- X_{ij} represents individual variables at the student level (gender, academic delay, socio-professional category);
- Z_j is the average level of students entering the second year at school j ;
- X_j represents the composition variables at school j (percentage of girls, percentage of students one year behind, percentage of favored socio-professional categories, etc.);
- α_j represents the effect of school j on the probability of success for student i
- e_{ij} represents a value per student (distinguishes students within schools)

Table 5 : Variables included in the model : Variables Used in the Model

Variable	Definition	Role in the Model
Success or Obtaining distinction in the final exam	Obtaining the diploma by or distinction the student	Dependent variable (binary): indicator of final academic performance. Used to assess the effectiveness of the school independently of students' initial characteristics.
GENDER	Student's sex	Individual explanatory variable (qualitative nominal): measures potential differences in achievement between girls and boys and controls for this effect.
AGE	Student's age at entry to upper secondary	Individual explanatory variable (quantitative continuous, recoded into classes): indicator of school delay or advancement, controls for age effects.
GRAD3RDC OLLEGE	Grade in 3rd Year of Middle School	Individual explanatory variable (quantitative continuous, recoded into classes): measure of initial academic capital to isolate the school's specific effect.
CATEGS OCIOECO	Socio-professional category of the student's guardian	Individual explanatory variable (qualitative ordinal): accounts for social background and family resources; controls for social inequalities.
AVERAGE-LEVEL	Average results at entry to upper secondary for the entire school	Contextual explanatory variable (quantitative continuous, recoded into classes): indicator of the initial academic level of intake.
PRCFAV TRA EV	Proportion of students from advantaged socio-professional categories	Contextual explanatory variable (quantitative continuous): measures the overall social profile of the school and its influence on achievement.
PRCDELAY	Proportion of students with school delay at entry to upper secondary	Contextual explanatory variable (quantitative continuous): evaluates the impact of the weight of school delay in the school.

Source: Author

2.3.2. ESTIMATION OF EXPECTED RATES

In this study, the analysis will be limited to value-added measures for success and distinction, due to the lack of sufficient data to calculate the access rate.

2.3.2.1. RESULT OF ESTIMATED EXPECTED SUCCESS RATE

Table 6 : Model parameters (SUCCESS Variable) :

Source	Valeur	Erreur standard	Khi ² de Wald	Pr > Khi ²	Wald Borne inf. (95%)	Wald Borne sup. (95%)	Odds ratio
CONSTANT	-3,180	0,247	165,167	<0,0001	-3,665	-2,695	
PRCDELAY	0,040	0,007	32,315	<0,0001	0,026	0,053	1,041
AGE	-0,223	0,061	13,549	0,000	-0,342	-0,104	0,800
PRCFAVTRA EV	0,020	0,005	12,918	0,000	0,009	0,030	1,020
GRAD3RDCOLLEGE	1,645	0,075	476,644	<0,0001	1,497	1,793	5,180
AVERAGE-LEVEL	0,377	0,100	14,306	0,000	0,181	0,572	1,457
GENDER -FEMALE	0,223	0,066	11,535	0,001	0,094	0,352	1,250
GENRE-MALE	0,000	0,000					
CATEGSOCIOECO-Disadvantaged	0,074	0,122	0,369	0,543	-0,164	0,312	1,077
CATEGSOCIOECO- Middle	-0,012	0,112	0,012	0,913	-0,233	0,208	0,988
CATEGSOCIOECO-FAVTRA EV	0,000	0,000					

Source: Author

- Before interpreting the coefficients of the variables, it is necessary to assess the statistical validity and robustness of the model by first examining multicollinearity, overall significance, goodness of fit, and calibration.

Table 7 : Evaluation of the Logistic Regression Model

Aspect	Main Results	Conclusion
Multicollinearity Check	-Tolerances > 0.2 - VIF < 5	No major multicollinearity issue
Overall Model Significance	- Test -2 Log (Likelihood): $\chi^2 = 870.998$ (df = 8, p < 0.0001) - Score Test: $\chi^2 = 812.241$ (df = 8, p < 0.0001) - Overall Wald Test: $\chi^2 = 714.463$ (df = 8, p < 0.0001)	The logit model is globally significant
Overall Goodness of Fit	- -2 Log (Likelihood): 6860.945 → 5989.947 -AIC: 6862.945 → 6007.947 -BIC: 6869.460 → 6066.580 -McFadden $R^2 = 0.127$ - Nagelkerke $R^2 = 0.214$ ($\approx 21.4\%$ variance explained)	Substantial improvement in fit, relevant explanatory power
Calibration Test (Hosmer-Lemeshow)	$\chi^2 = 6.824$ (df = 8, p = 0.556)	Model correctly calibrated (no significant difference between observed and predicted)

Source: Author

- Le logit model is broadly significant, with no major issues of multicollinearity. It shows satisfactory fit, with relevant explanatory power and good calibration. It can therefore be considered robust and valid for analyzing the determinants of academic success.

Table 8: Interpretation of Logistic Model Coefficients

Variable	Interpretation of Coefficients (Value + Significance)
CONSTANT	Negative constant (-3.180; p < 0.0001): very low probability of success in the absence of any other explanatory factor.
PRCDELAY	Positive coefficient (0.040; p < 0.0001): as the proportion of students with academic delays in the high school increases, success slightly increases (counterintuitive but significant). One possible explanation is that students who have repeated a grade may have acquired a better mastery of the curriculum and may benefit from more targeted academic support, thereby increasing their likelihood of success. However, the magnitude of the effect remains small and should be interpreted with caution, as it may also reflect unobserved school- or student-level characteristics not captured by the model.
AGE	Negative coefficient (-0.223; p = 0.000): older students are less successful. The older a student is, the lower their chances of success (effect of individual academic delay).

PRCFAVTRAEV	Positive coefficient (0.020; $p = 0.000$): a higher proportion of students from favored backgrounds in the institution significantly increases the chances of success.
GRAD3RDCOLLEGE	Strongly positive coefficient (1.645; $p < 0.0001$): academic level acquired in middle school has a decisive influence on success.
AVERAGE-LEVEL	Positive coefficient (0.377; $p = 0.000$) : a higher average level of students recruited into the institution significantly increases the probability of success.
GENDER -FEMALE	Positive coefficient (0.223; $p = 0.001$): girls are more successful than boys.
CATEGSOCIOECO-Disadvantaged	Non-significant coefficient (-0.012; $p = 0.913$).
CATEGSOCIOECO-Middle	Reference category (coefficient fixed at 0).

Source: Author

2.3.2.2. RESULT OF ESTIMATED EXPECTED DISTINCTION RATE

Table 9 : Model Parameters (Distinction Variable)

Source	Valeur	Erreur standard	Khi ² de Wald	Pr > Khi ²	Wald Borne inf. (95%)	Wald Borne sup. (95%)	Odds ratio
CONSTANT	-4,034	0,261	238,910	<0,0001	-4,546	-3,523	
PRCDELAY	0,030	0,008	16,025	<0,0001	0,016	0,045	1,031
AGE	-0,297	0,066	20,466	<0,0001	-0,425	-0,168	0,743
PRCFAVTRAEV	0,028	0,006	23,765	<0,0001	0,017	0,039	1,028
GRAD3RDCOLLEGE	1,776	0,072	612,728	<0,0001	1,636	1,917	5,909
AVERAGE-LEVEL	0,232	0,108	4,653	0,031	0,021	0,443	1,262
GENDER -FEMALE	0,264	0,071	13,844	0,000	0,125	0,404	1,303
GENRE-MALE	0,000	0,000					
CATEGSOCIOECO-Disadvantaged	0,061	0,120	0,263	0,608	-0,173	0,296	1,063
CATEGSOCIOECO-Middle	-0,113	0,109	1,071	0,301	-0,326	0,101	0,893
CATEGSOCIOECO-FAVTRAEV	0,000	0,000					

Source: Author

- Before commenting on the coefficients of the variables, it is important to ensure that the model is valid and reliable, by first checking the absence of multicollinearity, the overall relevance of the model, the quality of its fit, and its calibration

Table 10: Evaluation of the Logistic Regression Model

Aspect	Main Results	Conclusion
Multicollinearity Check	• Tolerances > 0.2 • VIF < 5	No major multicollinearity issues
Overall Model Significance	• -2 Log (Likelihood) Test: $\chi^2 = 1112.425$ (df = 8, $p < 0.0001$) • Score Test : $\chi^2 = 1085.901$ (df = 8, $p < 0.0001$) • Global Wald Test: $\chi^2 = 944.431$ (df = 8, $p < 0.0001$)	The logit model is globally significant
Overall Goodness-of-Fit	• -2 Log (Likelihood): 6582.664 $\rightarrow$ 5470.240 • AIC : 6584.664 $\rightarrow$ 5488.240 • SBC : 6591.179 $\rightarrow$ 5546.873 • McFadden's $R^2 = 0.169$ • Nagelkerke's $R^2 = 0.273$ ($\approx 27.3\%$ of variance explained)	Substantial improvement in model fit, relevant explanatory power
Calibration Test (Hosmer-Lemeshow)	$\chi^2 = 5.820$ (df = 8, $p = 0.667$)	Model correctly calibrated (no significant difference between observed and predicted values)

Source : Author

- The logit model is globally significant with no major multicollinearity issues. It has a satisfactory fit, relevant explanatory power, and is correctly calibrated. Therefore, it can be considered robust and valid for analyzing the determinants of obtaining distinction .

Table 11: Coefficient Interpretation (Distinction Variable)

Variable	Coefficient Interpretation (Value + Significance)
CONSTANT	Negative constant (-4.034; $p < 0.0001$): A very low probability of obtaining a distinction in the absence of all other explanatory factors.
PRCDELAY	Positive coefficient (0.030; $p < 0.0001$):, the probability of obtaining a distinction slightly increases
AGE	Negative coefficient (-0.297; $p < 0.0001$): Older students have a lower chance of getting a distinction (an effect of individual academic delay).
PRCFAVTRAEV	Positive coefficient (0.028; $p < 0.0001$): The higher the proportion of students from privileged backgrounds in the school, the greater the chances of obtaining a distinction.
GRAD3RDCOLLEGE	Strongly positive coefficient (1.776; $p < 0.0001$): Academic performance in middle school is the determining factor for obtaining a distinction in high school.
AVERAGE-LEVEL	Positive coefficient (0.232; $p = 0.031$): A higher average academic level of recruited students significantly increases the probability of obtaining a distinction.

GENDER -FEMALE	Positive coefficient (0.264; $p < 0.0001$): Females have a significantly higher probability of obtaining a distinction than males.
CATEGSOCIOECO-Disadvantaged	Non-significant coefficient (-0.113; $p = 0.301$): No significant effect compared to the reference category.
CATEGSOCIOECO-Middle	Reference category (coefficient set to 0).

Source: Author

2.4. CALCULATION AND ANALYSIS OF HIGH SCHOOL SUCCESS VA

Table 12: Success Value Added

School	Observed (or Raw) Success Rate	Expected Success Rate	Success Value Added	Rank by Observed Success Rate
S.Mohamed Ben Abdelkrim AlKhattabi	48.57	15.24	33.33	16
S.Al-Khawarizmi	47.77	15.18	32.59	18
S.Al-Mahdi Al-Manjra	54.46	24.75	29.7	10
S. Al-Karkarat	52.63	23.68	28.95	11
S. Abdelmoumen Al-Mouwahhid	42.52	16.82	25.7	23
S.Mohamed Elfakih Ar-Rakraki	48.84	23.72	25.12	15
S.Zaynab An-Nafzawiya	42.42	18.18	24.24	24
S.Abdallah Ach-Chafchaouni	46.56	24.29	22.27	19
S.Moulay Ali Charif	49.19	27.42	21.77	13
S.Al-Hansali	45.65	24.35	21.3	22
S.Al-Ghazali	59.69	38.78	20.92	6
S.Al-Mourabidine	50.0	31.58	18.42	12
S.Al-Jami'i	49.17	30.94	18.23	14
S.Allal Al-Fassi	55.5	37.56	17.94	9
S.Sidi Idriss	67.74	50.32	17.42	4
S.Ibn Al-Khatib	41.85	25.0	16.85	25
S. Mohamed Al-Wafaa	48.15	35.19	12.96	17
S. Al-Bassatine	35.92	24.27	11.65	27
S.Bir Anzaran	61.51	54.39	7.11	5
S.Ibn Zohr	40.0	33.79	6.21	26
S. Moulay Rachid	46.24	43.93	2.31	20
S.Abou Al-Abbas Assabti	55.69	56.92	-1.23	8
S.Abou Bakr Ar-Razi	46.2	48.91	-2.72	21
S.Moulay Youssef Technique	90.55	93.81	-3.26	1
S. Oued Eddahab	86.31	92.86	-6.55	2
S.Ibn Battouta	83.69	97.87	-14.18	3
S. Abdelkhalek Al-Touriss	58.78	91.6	-32.82	7

Source: Author

2.4.1. CLASSIFICATION OF SCHOOLS BY THEIR SUCCESS VALUE-ADDED

- **Schools with exceptional VA (≥ 25)**, demonstrating a strong impact on student success, such as Mohamed Ben Abdelkrim Al-Khattabi (33.33), Al-Khawarizmi (32.59), and Al-Mahdi Al-Manjra (29.70).
- **Schools with high VA ($15 \leq VA < 25$)**, which significantly exceed expectations, such as Zaynab An-Nafzawiya (24.24), Abdallah Ach-Chafchaoui (22.27).
- **Schools with average VA ($0 \leq VA < 15$)**, whose results are close to expectations, such as Mohamed Al-Wafaa (12.96), Al-Bassatine (11.65), and Bir Anzaran (7.11).
- **Schools with negative value-added ($VA < 0$)**, showing performance that is below forecasts and reflecting underperformance, such as Abou Al-Abbas Assabti (-1.23), Abou Bakr Ar-Razi (-2.72), and Ibn Battouta (-14.18).

2.4.2. COMPARATIVE ANALYSIS BETWEEN OBSERVED SUCCESS AND VALUE ADDED

A comparison between the raw baccalaureate success ranking and that based on value added reveals notable differences: **Schools that top the ranking in observed success**, such as Moulay Youssef Technique (90.55), Oued Eddahab (86.31), or Ibn Battouta (83.69), actually display **negative VA**, suggesting that their high performance mainly reflects the initial quality of their student intake rather than the school's pedagogical contribution. Conversely, several schools record **more modest raw success rates** but stand out through **high VA**. This is the case for Mohamed Ben Abdelkrim Al-Khattabi (48.57% observed but +33.33 VA) and Al-Khawarizmi (47.77 observed and +32.59 VA), which demonstrate a genuine capacity to foster student progress. Other schools, such as Sidi Idriss or Al-Ghazali, manage to combine good success rates with positive VA, reflecting balanced effectiveness. Finally, some schools like Ibn Zohr or Al-Bassatine appear to struggle, combining low success rates with limited VA.

2.5. CALCULATION AND ANALYSIS OF HIGH SCHOOL DISTINCTION VA

Table 13: Distinction Value Added

School	Observed Distinction Rate	Expected Distinction Rate	Distinction Value Added	Rank by Observed Distinction Rate
S.Oued Eddahab	63.1	42.26	20.83	3
S.Al-Karkarat	23.68	5.26	18.42	24
S.Al-Mourabitine	29.82	12.28	17.54	15
S.Mohamed Ben Abdelkrim AlKhattabi	30.48	15.24	15.24	14
S.Mohamed Elfakih Ar-Rakraki	27.44	13.95	13.49	19
S.Al-Khawarizmi	26.79	15.18	11.61	21

S.Abdelmoumen Al-Mouwahhid	27.57	16.82	10.75	18
S.Mohamed Al-Wafaa	31.48	22.22	9.26	13
S.Zaynab An-Nafzawiya	24.24	15.15	9.09	23
S.Al-Bassatine	19.42	10.68	8.74	27
S.Abdallah Ach-Chafchaoui	28.74	20.24	8.5	16
S.Al-Mahdi Al-Manjra	32.18	24.75	7.43	12
S.Al-Jami'i	32.6	27.62	4.97	11
S.Ibn Al-Khatib	27.72	25.0	2.72	17
S.Al-Hansali	26.96	24.35	2.61	20
S.Al-Ghazali	39.29	38.78	0.51	8
S.Bir Anzaran	41.42	41.0	0.42	6
S.Allal Al-Fassi	37.08	37.56	-0.48	9
S.Moulay Ali Charif	23.39	24.19	-0.81	25
S.Abou Al-Abbas Assabti	40.62	42.46	-1.85	7
S.Sidi Idriss	44.52	47.1	-2.58	5
S.Abou Bakr Ar-Razi	35.87	39.67	-3.8	10
S.Moulay Rachid	25.43	31.21	-5.78	22
S.Moulay Youssef Technique	77.85	87.3	-9.45	1
S.Ibn Zohr	21.38	32.41	-11.03	26
S.Ibn Battouta	72.34	85.11	-12.77	2
S.Abdelkhalek Al-Touriss	45.04	69.47	-24.43	4

Source: Author

2.5.1. CLASSIFICATION OF SCHOOLS BY THEIR VALUE-ADDED FOR DISTINCTION

Schools can be grouped into four categories based on their value-added for distinction.

- **The first category includes those with exceptional VA ($\geq 15\%$),** reflecting a remarkable effect on students obtaining distinctions, such as School Oued Eddahab (20.83 %), school Al-Karkarat school (18.42 %), Al-Mourabidine (17.54 %).
- **The second category corresponds to schools with high VA ($5\% \leq VA < 15\%$),** which contribute significantly and consistently to students earning distinctions, such as Schools : Mohamed Elfakih Ar-Rakraki (13.49 %), Al-Khawarizmi (11.61 %),
- **The third category includes schools with average VA ($0 \leq VA < 5\%$),** whose results are close to initial expectations, such as schools Al-Jami'i (4.97 %), Ibn Al-Khatib (2.72 %),
- **Finally, the fourth category brings together schools with negative VA ($VA < 0\%$),** showing fewer distinctions than expected, such as schools : Moulay Ali Charif (-0.81 %), Abou Bakr Ar-Razi (-3.80 %), and Ibn Battouta (-12.77 %).

2.5.2. COMPARATIVE ANALYSIS OF OBSERVED DISTINCTION AND VALUE-ADDED

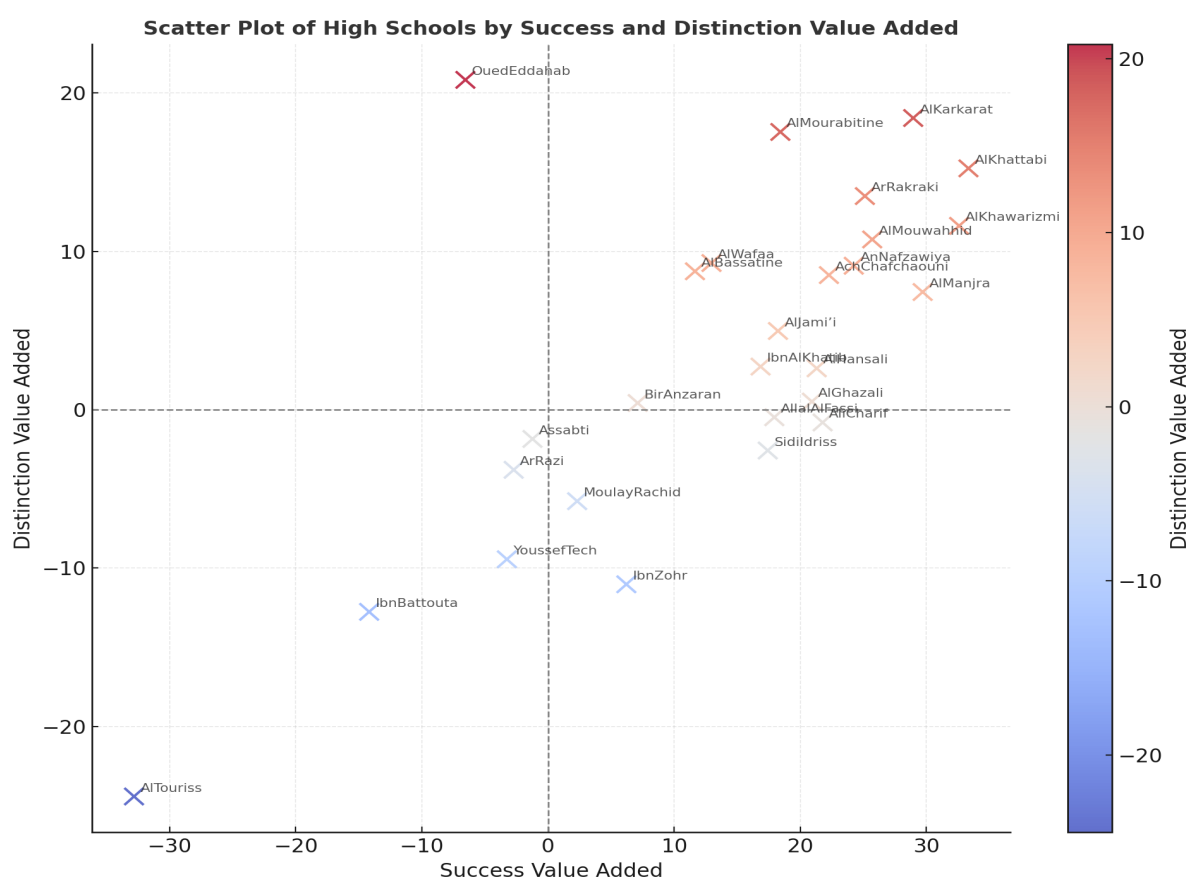
Comparing the two rankings – based on observed distinction rates versus value-added – reveals notable differences. Raw rankings tend to favor schools admitting students with already strong academic profiles. For instance, Moulay Youssef Technique and Ibn Battouta, ranked 1st and

2nd in raw success, exhibit negative value-added, indicating that their results depend more on student selection than on pedagogical contribution. In contrast, several schools with modest raw rankings demonstrate high value-added. S.Collégial Al-Karkarat (18th in observed distinctions, 1st in value-added) and S.Al-Mourabitine (12th in observed distinctions, 2nd in value-added) notably improve student outcomes beyond expectations. Some schools, such as Oued Eddahab and Al-Mahdi Al-Manjra, combine high distinction rates with positive value-added, reflecting genuine teaching effectiveness. Finally, certain schools underperform in both measures, including Ibn Zohr, Moulay Rachid, and Abdelkhalek Al-Touriss, the latter showing the lowest distinction rate and value-added.

In summary, ranking schools by value added helps qualify the interpretation of raw performance rankings by distinguishing elite schools, whose results stem mainly from selective student intake, from those that, despite serving more disadvantaged populations, make a significant pedagogical contribution to their students' success or to obtaining distinction.

2.6. CROSS-ANALYSIS OF VALUE ADDED : SUCCESS VS DSTINCTION

Figure 9 : scatter plot of value added : success vs distinction



Source: Author

This cross-analysis highlights **four main profiles of schools**, depending on their relative performance in both indicators.

- Upper right quadrant (VA success > 0 ; VA distinction > 0):

High-performing or excellence schools: These schools achieve strong results in both success rates and distinctions, reflecting overall pedagogical effectiveness and balanced academic support, such as: S.Mohamed Ben Abdelkrim Al-Khattabi (33.33; 15.24), S.Al-Khawarizmi (32.59; 11.61), S.Al-Karkarat (28.95; 18.42), S.Al-Mahdi Al-Manjra (29.70; 7.43),

- Upper left quadrant (VA success < 0 ; VA distinction > 0):

Qualitative or selective schools : They record fewer overall successes but a relatively high share of distinctions, suggesting more selective but higher-quality academic performance, such as: S.Oued Eddahab (-6.55; 20.83).

- Lower right quadrant (VA success > 0 ; VA distinction < 0):

Safe or facilitator schools: These schools secure a relatively high success rate but with few distinctions, indicating **quantitative rather than qualitative** performance, such as: S.Moulay Ali Charif (21.77; -0.81), S.Allal Al-Fassi (17.94; -0.48), S.Sidi Idriss (17.42; -2.58), S.Ibn Zohr (6.21; -11.03),

- Lower left quadrant (VA success < 0 ; VA distinction < 0):

Fragile or struggling schools: They obtain low results in both success rates and distinctions, revealing generalized academic difficulties and the need for targeted pedagogical support, such as: S.Abdelkhalek Al-Touriss (-32.82; -24.43), S.Ibn Battouta (-14.18; -12.77), S.Moulay Youssef Technique (-3.26; -9.45),

CONCLUSION

This study assessed the performance of qualifying secondary schools under the Tangier-Assilah Provincial Directorate of the Ministry of National Education using Value-Added Indicators (VAIs), providing a fairer assessment than traditional approaches based solely on examination pass rates.

The findings reveal substantial differences in performance across schools. Some schools generated high value added despite operating in disadvantaged socio-economic contexts, whereas others performed below expectations despite enrolling students with more favorable initial characteristics. These results highlight the limitations of traditional performance indicators and confirm the relevance of VAIs in measuring schools' actual educational contribution.

The main contribution of this study is the development of a two-dimensional value-added model adapted to the Moroccan context, combining value added for graduation (VA-Graduation) and value added for distinction (VA-Distinction). This framework provides a more comprehensive assessment of school performance by simultaneously capturing both educational equity and academic excellence.

Overall, VAIs represent a valuable tool for improving school evaluation and supporting evidence-based educational policymaking. Future research should extend this approach to a larger national sample, employ multilevel modeling, and integrate Machine Learning techniques to improve value-added estimation and identify its main determinants.

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