Could Minimum Grading Enhance High School Graduation Rates and Cost-Effectiveness Across Arkansas?

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Abstract: High school graduation is a pivotal milestone that can shape students' future, offering them opportunities for higher education and gainful employment. Because research shows grade point averages and course failures to be predictive of high school graduation, it is important for students' life outcomes that their teachers assign them equitable grades. However, recent research has scrutinized how schools have traditionally graded students, calling for new approaches such as minimum grading. In this analysis, we simulate the economic impacts of implementing a minimum grading policy statewide during the ninth-grade year of the cohort of students who were in ninth grade in 2015-16 in Arkansas. On average, in Arkansas public schools, we estimate that minimum grading would affect about one (narrow bound) to 3% (broad bound) of students, increase cost-effectiveness by 6% (narrow bound) to 23% (broad bound), largely varying across districts, and have essentially no impact on the return on investment. The application of minimum grading shifted 1% of failing course grades to passing, thereby positioning 10% of previously failing students to pass. These findings suggest that minimum grading could serve as a cost-effective strategy to enhance graduation rates in districts with higher rates of affected students, without necessitating additional educational spending.

¿Podría la clasificación mínima mejorar las tasas de graduación de la escuela secundaria y la relación costo-beneficio en Arkansas?

Resumen: La graduación de la escuela secundaria es un hito fundamental que puede moldear el futuro de los estudiantes, ofreciéndoles oportunidades de educación superior y empleo remunerado. Debido a que las investigaciones muestran que los promedios de calificaciones y los fracasos en los cursos predicen la graduación de la escuela secundaria, es importante para los resultados de vida de los estudiantes que sus maestros les asignen calificaciones equitativas. Sin embargo, investigaciones recientes han analizado cómo las escuelas tradicionalmente calificaban a los estudiantes, solicitando nuevos enfoques, como la calificación mínima. En este análisis, simulamos los impactos económicos de implementar una política de calificación mínima en todo el estado durante el año de noveno grado de la cohorte de estudiantes que estaban en noveno grado en 2015-16 en Arkansas. En promedio, en las escuelas públicas de Arkansas, estimamos que la calificación mínima afectaría entre uno (límite estrecho) y 3% (límite amplio) de los estudiantes, aumentaría la rentabilidad entre un 6% (límite estrecho) y un 23% (límite amplio), varían en gran medida entre distritos y esencialmente no tienen ningún impacto en el retorno de la inversión. La aplicación de calificaciones mínimas cambió el 1% de las calificaciones de cursos reprobados a aprobados, posicionando así al 10% de los estudiantes que anteriormente reprobaban para aprobar. Estos hallazgos sugieren que las calificaciones mínimas podrían servir como una estrategia rentable para mejorar las tasas de graduación en distritos con tasas más altas de estudiantes afectados, sin necesidad de gasto educativo adicional.

Palabras-clave: calificación mínima; graduación de bachillerato; promedio de calificaciones; reforma de calificaciones; retorno de la inversión

A classificação mínima poderia melhorar as taxas de conclusão do ensino médio e a relação custo-benefício no Arkansas?

Resumo: A conclusão do ensino médio é um marco fundamental que pode moldar o futuro dos estudantes, oferecendo-lhes oportunidades de ensino superior e emprego remunerado. Como a pesquisa mostra que as médias de notas e as reprovações nos cursos são preditivas da conclusão do ensino médio, é importante para os resultados de vida dos alunos que seus professores lhes atribuam notas equitativas. No entanto, pesquisas recentes examinaram minuciosamente a forma como as escolas tradicionalmente classificam os alunos, apelando a novas abordagens, como a classificação mínima. Nesta análise, simulamos os impactos económicos da implementação de uma política de notas mínimas em todo o estado durante o ano do nono ano do grupo de alunos que estavam no nono ano em 2015-16 no Arkansas. Em média, nas escolas públicas do Arkansas, estimamos que a classificação mínima afetaria cerca de um (limite estreito) a 3% (limite amplo) dos alunos, aumentaria a relação custo-eficácia em 6% (limite estreito) a 23% (limite amplo), variam grandemente entre distritos e não têm essencialmente impacto no retorno do investimento. A aplicação da nota mínima transferiu 1% das notas reprovadas do curso para aprovação, posicionando assim 10% dos alunos anteriormente reprovados para aprovação. Estas conclusões sugerem que a classificação mínima poderia servir como uma estratégia eficaz em termos de custos para melhorar as taxas de graduação em distritos com taxas mais elevadas de estudantes afetados, sem necessidade de despesas educacionais adicionais.

Palavras-chave: classificação mínima; graduação do ensino médio; média de qualificações; reforma de classificação; retorno do investimento

Could Minimum Grading Enhance High School Graduation Rates and Cost-Effectiveness Across Arkansas?

High school graduation is not merely a rite of passage, but a pivotal milestone that can shape students' future, offering them opportunities for higher education and gainful employment (Allensworth & Easton, 2007; Aspire Arkansas, 2023). In 2023, the state of Arkansas ranked 42nd in the nation on high school graduation with a graduation rate of only 88%, down from 89% in 2020, when Arkansas ranked 15th on high school graduation (National Center for Education Statistics, 2023; Wisevoter, 2023; Aspire Arkansas, 2023). Not only is Arkansas' high school graduation rate bleak; in 2023, Arkansas' bachelor's degree obtainment rate ranked 49th in the nation, at 25.3%, and its advanced degree obtainment rate ranked 50th, at 9.4% (Wisevoter, 2023).

One aspect that can play a role in a student's journey toward high school graduation is their grade-point averages and course failures. The way students have traditionally been graded in K-12 schools is under increasing scrutiny for inconsistencies and biases. Critics argue that traditional grading practices, including student non-academic behaviors in their final grades, perpetuate disparities among students of different backgrounds, contributing to achievement gaps (Feldman, 2018; Guskey, 2015). In response to traditional grading practices, "equitable grading practices," such as grading students only on the standard and not incorporating non-cognitive behaviors in the grades, have emerged as an alternative (Feldman, 2018; Guskey, 2022).

Recent empirical findings by Bowden et al. (2023) caution against reducing grading scales, expressing concerns that such policies may raise grade point averages (GPAs) without improving academic outcomes. However, their assumptions rely on the premise that a change in GPA directly should correlate with a change in test scores. We would expect this correlation if students were consistently assessed using grading practices that accurately measure their content knowledge from the outset, but the very premise of equitable grading advocacy is that traditional grades do not accurately reflect students' knowledge. Educators who have embraced equitable grading practices report numerous advantages, including increased accuracy and reduced bias in grading, but also heightened student motivation, improved teacher-student relationships, reduced classroom stress, lower failure rates, mitigation of grade inflation, grades that more precisely mirror students' academic capabilities, reduced anxiety among students, enhanced self-efficacy, and the cultivation of a fair and equitable learning environment (Feldman, 2018; Fernandez, 2020).

Modern schooling in the U.S. has placed added pressure on schools to reduce student failures and dropout rates, and with tight budgets, educators must consider effective, low-cost options (Carifio & Carey, 2010). The minimum grade is one equitable grading practice that emerges as a potentially cost-effective policy implementation. Minimum grading restricts educators from assigning grades below a specific threshold, typically 50, to address the mathematical inaccuracy between the 0-100-point scale and the A-F scale. Massachusetts researchers Carifio and Carey (2009) argue that the minimum grading policy should be implemented in schools first for its grounding in educational and psychological theory and later bolster their argument with empirical findings. They find that implementing a minimum grade to mid-semester final grades changes 8.4% of students' final grades and that the students who would be affected by the minimum grade outperformed their peers of similar prior academic achievement on the state standardized test (Carey & Carifio, 2012). While minimum grading appears to have benefits in terms of student outcomes, it requires no additional costs to

implement. The researchers even claim implementing the minimum grade would save the Massachusetts school district they studied $1 million over seven years, later to revise their estimate of savings to $2 million (Carey and Carifio, 2012; Carifio & Carey, 2013). Researchers studying equitable grading widely cite Carifio and Carey's findings.

While saving money through minimum grading--by eliminating the need for some students to retake required courses, attend summer school, or enroll in credit recovery programs--is logically sound, Carey and Carifio's research lacks direct calculations to support this cost-savings estimation. Neither does their research address the potential long-term financial benefits of minimum grading. We aim to assess the short- and long-term economic benefits of minimum grading through changes in graduation rates by simulating the implementation of minimum grading within Arkansas public schools in the cohort of students who completed their ninth-grade year in 2015-16.

In this paper, we simulate the implementation of a minimum grading policy to answer the following questions:

RQ1: Could a minimum grading policy enhance the economic efficiency of Arkansas public schools by improving graduation rates without increasing the cost of educating students?

RQ2: Would implementing minimum grading in Arkansas public schools boost the return on investment (ROI) by increasing students' lifetime earnings without additional expenditures?

Literature Review

Equitable Grading

Grading practices have historically shown minimal evolution over the past century (Feldman, 2018; Schneider & Hutt, 2013). These practices have often been associated with outdated beliefs about sorting students and criticized for their potential role in perpetuating student disparities. The traditional grading system, rooted in an era when schools relied on extrinsic reinforcement and punitive measures, is facing scrutiny for its inconsistency and imprecision in modern educational settings (Schneider & Hutt, 2013). Despite their significant influence on students' lives (Guskey, 2015; Morris & McKenzie, 2024a) and their need to be more meaningful to reflect what students know and can do, grading practices exhibit inherent biases, disproportionately affecting economically disadvantaged students (Morris & McKenzie, 2024b; Wakeman et al., 2022). Grading reform advocates like Thomas Guskey (2020) and Joe Feldman (2019) call upon educators to reevaluate traditional grading approaches, including grading homework completion, class participation, punctuality, behaviors, and efforts in the final grade, which often unintentionally privilege sure students while disadvantaging marginalized groups.

Feldman's (2018) suggestions include adopting consistent grading scales, removing extra credit opportunities, grading students solely on content knowledge, excluding non-academic behaviors from grades, and eliminating homework participation grades to accommodate diverse student circumstances. The deduction of points for student behavior may be susceptible to misinterpretation and implicit biases, given their subjective nature (Feldman, 2019). Once perceived as a measure of responsibility, homework completion now exacerbates economic disparities among students, as not all possess conducive home environments for learning (Feldman, 2019). Additionally, educators who emphasize homework completion as a behavioral indicator unintentionally perpetuate achievement gaps rooted in students' economic

backgrounds (Feldman, 2019). The practice of averaging grades over time may also prove inequitable, as it may fail to accurately represent students' actual abilities, potentially disadvantaging those who initially struggled but ultimately mastered the content (Feldman, 2019). These illustrative examples emphasize the importance of considering shifts toward more equitable grading practices within the field of education.

While the field has seen limited research measuring the impact of equitable grading practices, external evaluations conducted by consulting groups reveal compelling advantages. These practices have demonstrated greater accuracy, resistance to bias, increased student motivation, and fostered stronger teacher-student relationships (Feldman, 2018). Equitable grading practices are associated with less stressful classroom environments, reduced failure rates, minimized grade inflation, and disrupt the cycle of achievement disparities, resulting in grades that more closely align with student test scores (Feldman, 2018). Additionally, a mathematics professor's findings support adopting equitable grading methods; allowing students to retake assessments reduces anxiety and enhances self-efficacy, reshaping their perceptions of grades and nurturing a sense of fairness and equity in their learning journey (Fernandez, 2020). Amidst these promising equitable grading practices, minimum grading stands out to address the mathematical inaccuracies inherent in the traditional grading scale.

Minimum Grading

Minimum grading, an equitable grading and no-cost grading policy approach, anchors the 0-100-point scale, typically at 50, and provides schools with a valuable tool to address issues related to failure rates and attrition (Carifio & Carey, 2009). While implementing minimum grading may vary, the policy generally restricts teachers from assigning grades below a specified threshold, often set at 50 (Carifio & Carey, 2009). Its origins can be traced back to the need to tackle problems associated with students receiving exceptionally low first-quarter grades, which left them with little chance of passing the course and limited options for recovery (Carifio & Carey, 2009). Many students may struggle, not as much with content as with the grading and assessment system, which is where minimum grading addresses their needs (Carifio & Carey, 2010).

Assigning catastrophically low grades early in the school year can trigger defensive and often self-destructive responses in students; a single catastrophic failure can suddenly stop even motivated and engaged students (Carifio & Carey, 2010). Although no single solution can eliminate student failures, minimum grading could be an effective grading strategy in addressing early catastrophic failures, offering struggling students a better chance to recover without suffering undue punishment for their setbacks (Carifio & Carey, 2013). While the primary goal of minimum grading is not to pass students who would otherwise fail, it aims to mitigate the impact of extreme outliers in grading, particularly benefiting disadvantaged students facing disruptions beyond school hours, preserving students' motivation and engagement (Carifio & Carey, 2012).

Minimum grading challenges the punitive nature of grading, as Douglas Reeves (2004) argues against using zeros due to their misalignment with the 0-100-point scale and the A-F grading system. The first letters of the grading scale remain 10 points between one another, yet the last letter, an F, receives 60 points of failure possibilities for students. He argues failing shouldn't cover a disproportionate three-fifths of a grading scale and passing only two-fifths (Reeves, 2004). While Reeves (2004) notes that many educators are too invested in utilizing the symbolic 0 for zero work and that teachers might favor a 0-4-point scale more due to this, grading researchers still suggest that when students receive a zero, they are less motivated (Guskey & Bailey, 2001). Other grading reformers propose Standards-Based Grading (SBG),

only grading students on their content knowledge without marks on soft skills included, as an alternative to the 0-100-point grading scale to help students focus more on their learning (Brookhart, 2017; Guskey, 2015; Morris & Barton, 2022). Nevertheless, critics of the minimum grading scale caution against mathematical manipulations to the grading scale without an overhaul to reexplain the purpose of grades (Bowden et al., 2023; Guskey, 2020; Stiggins, 2005). Some grading researchers argue that redefining the purpose of grading for all stakeholders involved is the crucial step necessary to improve learning (Brookhart, 2017; Guskey, 2020).

Carifio and Carey (2009) started their minimum grading research based on theory, noting the lack of research exploring the effectiveness of minimum grading, and most proponents only argue for the practice through hypothetical and theoretical arguments. The researchers then provide various models of motivation, including achievement motivation, locus of control, attribution theory, self-worth theory, and self-efficacy, that all predict that standard grading practices--such as grading for effort, using grades as rewards and punishments, and assigning punishingly low grades--often both encourage and produce results opposite from those intended (Carifio & Carey, 2010).

Carey and Carifio then bolster their theoretical arguments with quantitative data to support minimum grading policies. Carey and Carifio's (2012) comprehensive seven-year study of simulating district grading data yielded compelling results regarding the impact of minimum grading policies. Their analysis found that no evidence of grade inflation or social promotion would be found in schools where minimum grading was implemented. Applying the minimum grade at the macro level to mid-point grades affected 8.4% of the district's students. Despite a mere 0.3% of grades with initial minimum grades of 50 ultimately achieving passing course grades, students who would had received minimum grades consistently outperformed their peers on state standardized tests, even after adjusting for grade point averages. Carey and Carifio's (2012) study suggests that traditional grading practices may significantly underreport the academic abilities of struggling students compared to their better-performing counterparts.

Furthermore, Carey and Carifio (2012) estimate the financial benefits of minimum grading in an article in Educational Researcher, finding that the district they examined saved a substantial amount, including approximately $150,000 annually in summer school costs alone, totaling over $1,000,000 in savings over their seven years of data. Their findings highlight the potential for minimum grading policies to benefit students academically and contribute to significant cost savings for school districts, making it a compelling approach for education systems seeking equitable practices. However, the researchers challenged their own findings in a later analysis of the same district that indicated even more significant savings. Carifio and Carey (2015) suggested that the yearly savings to the district amounted to $285,000 for 142 students who did not need to retake a course they had not initially failed, equating to roughly $2,000,000 over seven years.

While minimum grading may not eliminate traditional grading inequities, it is shown to offer a safeguard by mitigating teachers' inherent biases when assessing substandard work. Research has demonstrated that minimum grading minimizes the catastrophic impact of failure by reducing punitive consequences for students and providing them with an opportunity for growth and development (Carifio & Carey, 2015). Although the probability of students who receive minimum grades still failing a course or quarter remains high, it is not disproportionately and unfairly so, allowing for success when past and future performance reflects high-quality work (Carifio & Carey, 2015). Carifio and Carey's work demonstrates the multifaceted benefits of minimum grading, from financial savings to promoting equitable practices and student educational development and opportunities.

Critics of minimum grading have expressed concerns that the practice may inadvertently lower minimum competency requirements and contribute to overall grade inflation (Carifio & Carey, 2009; Freiss, 2008). However, while Carifio and Carey provide empirical evidence, criticism of minimum grading has largely not been supported by empirical evidence. A working paper by Bowden et al. (2023) is the only empirically supported case against equitable grading practices. The authors' report assumes that a change in GPA should equate to a change in test scores, but their framework overlooks the purpose of minimum grading as a calibrator to course grades and GPAs in an attempt to reflect students' actual learning.

Moreover, insights from three separate dissertations shed light on teachers' and administrators' perspectives regarding minimum grading. Long's (2017) qualitative study conducted in a low-achieving school in Southern Nevada revealed a preference among administrators for the minimum grade policy. Nonetheless, concerns among teachers persisted, with worries that minimum grading might compromise student agency, accountability, and the provision of comprehensive performance information (Long, 2017). Another study by Mitchell (2023) suggests that providing adequate preparation and training to teachers for implementing grading system changes can foster positivity and success within school systems. Such support can empower teachers to implement positive changes that benefit their confidence and students' learning outcomes. Williams's (2020) qualitative study findings indicated that teachers generally agree that implementing minimum grading policies has been suboptimal and has altered their understanding of grades and the purpose of grading itself. These diverse perspectives provide valuable insights into the practical challenges and benefits of implementing minimum grading policies.

The Ninth-Grade Year

The ninth-grade year is significant in a high school student's academic journey, garnering attention from both researchers and educators. This critical year can shape students' future educational paths, and it is often considered the "make-or-break" point for high school graduation and college enrollment (Allensworth & Easton, 2007; Phillips, 2019). Research conducted by the University of Chicago's Consortium on School Research highlights the strong correlation between ninth-grade grade point averages (GPAs) and subsequent academic achievements (Allensworth & Easton, 2007; Easton et al., 2017). Other researchers have found that addressing course failures early in the ninth-grade year can significantly increase graduation rates, as well (Balfanz et al., 2007).

In Chicago Public Schools, a ninth-grade student's GPA explains nearly 40% of the variation in high school graduation rates, surpassing the explanatory power of students' gender, race, socioeconomic status, and prior achievement, which collectively account for only 12% of the variation (Allensworth & Easton, 2007). Notably, even a single course failure during the ninth-grade year can predict a substantial portion of non-graduates, with students who fail a year-long required ninth-grade course labeled as "off-track" having just a 22% chance of graduating high school, making them four times less likely to graduate (Allensworth & Easton, 2007). Conversely, ninth-grade students who successfully pass all their courses in that crucial year have an approximately 85% chance of graduating high school (Allensworth & Easton, 2007).

Further research by Easton et al. (2017) underscores the significance of ninth-grade performance. They observed a notable disparity in graduation rates between students with D-average GPAs (60% chance of graduating) and those with F-average GPAs (18% chance of graduating). While students with A, B, and C average GPAs in ninth grade typically graduate on time in Chicago, a 24-percentage-point gap exists between D average students (60% chance) and

C average students (84% chance) (Easton et al., 2017). These findings emphasize that while students can indeed recover from poor ninth-grade performance, many remain on the academic trajectory established during that critical year. External research, such as that conducted by Bowers et al. (2013), supports the assertion that grades and course failures are among the most accurate indicators of high school dropout rates. Furthermore, research in Arkansas has demonstrated that failing at least one course during the ninth-grade year reduces the likelihood of graduating high school by a significant 22 percentage points (Morris & McKenzie, 2024a), similar to Chicago's "off-track" likelihood findings.

Arkansas Context

In Arkansas, high school graduation represents a crucial milestone in a student's academic journey and serves as a gateway to various future opportunities, including college education and employment (Aspire Arkansas, 2023). The Alliance for Excellent Education (2013) estimated that increasing the graduation rate for the Arkansas class of 2012 from 71% (actual) to 90% (goal) would increase annual earnings for the class by $64 million, increase spending in the state economy by $49 million each year, contribute an additional $81 million to the gross state product annually, generate an additional $9.7 million in federal income tax revenue and an additional $4.9 million in state and local tax revenues, and lead to increases in job creation, home sales, and auto sales. "The best economic stimulus package," they conclude, "is a high school diploma" (Alliance for Excellent Education, 2013, p. 1). Graduating high school, compared to dropping out, can improve a student's personal economic prospects but also has important externalities for society.

In recent years, Arkansas' graduation rate has declined. While in 2020, the state ranked 15th in the U.S. for high school graduation, with an 89% graduation rate, the rate dropped to 42nd in 2022, with only 88% of students graduating within the standard four-year timeframe (Aspire Arkansas, 2023). Arkansas's bachelor's degree rate ranks 49th in the nation at 25.3%, and it's advanced degree rate ranks 50th at 9.4% (Wisevoter, 2023). Comparatively, in 2022, Massachusetts and Pennsylvania boasted the highest high school graduation rates at 96.1% and 95.9%, respectively (Wisevoter, 2023).

According to state-level data from 2022 from Aspire Arkansas (2023), the graduation rate varied across student groups in Arkansas. Asian students had the highest graduation rate at 95%, followed closely by white students at 90%. Hispanic or Latino students achieved an 87% graduation rate, while Black and economically disadvantaged students had an 85% graduation rate. Furthermore, students with disabilities and English language learners had graduation rates of 83% and 82%, respectively. Any efforts to improve graduation rates should take this heterogeneity into consideration.

The National Center for Education Statistics employs an adjusted cohort graduation rate that accounts for student mobility, revealing that the adjusted Arkansas rate for the graduating class of 2020 was 89% (NCES, 2023). Factors such as funding, school resources, teacher quality, and socioeconomic conditions can significantly influence graduation rates, and high rates may reflect successful efforts to support students. In contrast, lower graduation rates signal a need for targeted interventions and improvements in the education system (Wisevoter, 2023).

Analyzing factors contributing to graduation rates in Arkansas, Bradley-Dorsey and McKenzie (2020) found that larger graduating class sizes were a significant positive predictor for higher graduation rates. However, they also found that students participating in free- or reduced-price lunch programs were less likely to graduate when compared to their more advantaged peers. Additionally, schools exclusively serving grades 10-12 or 11-12 positively impacted graduation rates (Bradley-Dorsey & McKenzie, 2020). Notably, economically

disadvantaged students consistently lagged three percentage points behind their financially advantaged counterparts (Bradley-Dorsey & McKenzie, 2020).

To improve high school graduation rates and align educational policies with workforce development, Arkansas implemented a statewide requirement for students to take at least six career-oriented courses (Dougherty et al., 2019). This policy change positively impacted Arkansas students' educational and labor market outcomes, especially in a state with lower per capita economic activity (Dougherty et al., 2019). Furthermore, students who enrolled in more career and technical education (CTE) courses were found to be more likely to graduate within the standard four-year timeframe (Dougherty et al., 2019).

Cost-Benefit Analysis

Education researchers often give policy recommendations based on the observed benefits of an educational intervention. However, Harris (2009) argued that these effects must be weighed against the cost of intervention to understand whether the net benefit of an intervention is positive. This contrast is formally called a "cost-benefit analysis" (Levin et al., 2018; Belfield and Bowden, 2019). For example, education researchers have used cost-benefit analysis to study whether financing a private school voucher program (Wolf and McShane, 2013) or charter schools (Wolf et a., 2014; DeAngelis et al., 2018, 2019, 2021; Johnson et al., 2023) with taxpayer dollars pays off in long-term public financial benefits, such as increased lifetime earnings of participants, which stimulates the economy and increases tax revenue.

A cost-effectiveness analysis considers the costs and benefits of multiple interventions to determine which produces the desired outcomes for the lowest cost (Levin and Belfield, 2015). For example, Hollands et al. (2014) conducted a cost-effectiveness analysis to examine whether programs designed to keep students from dropping out are worth the investment. They found that on average, the costs of producing an additional high school graduate through one of the programs ranged from $70,000 to $195,000 per additional graduate. Taking these results together with the findings on the trajectory-setting importance of ninth grade course grades from the University of Chicago Consortium on School Research, as well as Carey and Carifio's research suggesting that minimum grading would decrease students' course failures as well as educational costs, it is possible that implementing minimum grading might be a very cost-effective way to increase graduation rates, compared to other interventions.

Typically, education economics research distinguishes between private benefits—benefits to the student—and public benefits—benefits to society. The extant literature on equitable grading primarily focuses on private benefits. Very little of the research on minimum grading has examined its public benefits, with only Carey and Carifio's informally-presented calculations bearing the weight of the need for empirical evidence (Carey & Carifio, 2012; Carifio & Carey, 2013). More research should focus on the economic benefits of minimum grading, specifically the public economic benefits, to close this gap.

Methods

In the following analysis, we examine how minimum grading might increase Arkansas public schools' cost-effectiveness and ROI by boosting graduation rates without increasing spending. Minimum grading may even decrease spending, as reducing the number of failed courses may reduce the resources required for a student to recover failed credits (Carifio and Carey, 2012). However, because of the heterogeneity across Arkansas school districts in terms of policies allowing a student to recover failed courses and the resulting inconsistencies in data reporting, we do not have sufficient data to make assumptions about reducing costs from

minimum grading. Therefore, we assume minimum grading would not affect educational costs per student. Under this assumption, it is not helpful to estimate the cost per additional graduate for this intervention (e.g., following Hollands et al., 2014), since the cost per additional graduate would be $0. Rather, we examine cost-effectiveness by calculating the expenditures required to educate students who will never graduate, both under traditional and minimum grading schemes. Under this definition, if minimum grading decreases the costs of educating non-graduating students, it is more cost-effective than the current grading practices in place in Arkansas, therefore providing benefits to the public through more efficient use of taxpayer dollars. We also estimate the ROI for Arkansas public schools by dividing estimated lifetime earnings for the 2019 cohort by costs of educating these students, with and without minimum grading. If minimum grading increases the projected ROI for Arkansas schools, this represents potential benefits to the public through increased money flowing into the Arkansas and national economies, as well as increased tax revenue.

While it is impossible to demonstrate that a student who did not graduate would indeed have graduated under the implementation of minimum grading, we provide two estimates of the influence of minimum grading on cost-effectiveness and ROI, one assuming all students within the narrow bound would graduate high school and one assuming all students within the broad bound would graduate high school under minimum grading.

Data and Sample Characteristics

We utilized anonymized student-level data provided by the Arkansas Department of Education from a well-established Research Practice Partnership relationship with the Office for Education Policy, focusing on a sample of Arkansas ninth-grade students from the most recent available high school graduation year of data. The sample, consisting of 32,894 first-time, full-time ninth-grade students, includes 2014-15 eighth-grade achievement scores, 2015-16 ninth-grade students and course data, district characteristics data, and 2019 high school graduation data. Given the precedent set by research emphasizing the significance of ninth-grade course failures (Allensworth & Easton, 2007; Easton et al., 2017; Morris & McKenzie, 2024a), our analysis follows only a ninth-grade cohort of students.

The data contains student demographic and programmatic attributes and course grades. Course grades within the provided data are represented by numerical or grade letter values. We generated a binary indicator for our analysis to delineate student course failures as receiving an F (fail), NC (not complete), I-0 (incomplete-zero), or any grade below 60. Table 1 shows the demographic characteristics of the sample.

Table 1
Demographic and Programmatic Characteristics, FY16 Ninth-Grade Cohort

	n	%
Female	16,173	49.2
White	21,209	64.5
Black	6,573	20.0
Hispanic	3,612	11.0
Other Races	1,500	4.5
Free- or Reduced-Price Lunch	19,051	57.9
Gifted and Talented	4,439	13.5
English Language Learning	2,168	6.6
Special Education	3,457	10.5

Among the 32,894 students in the sample, females account for 49.2%, while most students identify as White (64.5%), followed by Black (20.0%), Hispanic (11.0%), and other racial backgrounds (4.5%). Additionally, 57.9% of our sample qualifies for Free- or Reduced-Price Lunch (FRL). Other programmatic characteristics are as follows: 13.5% enrolled in the Gifted and Talented (GT) program, 6.6% classified as English Language Learners (ELL), and 10.5 receive special education (SPED) services.

School Finance Data

To estimate the amount spent on a student's education, we use the Annual Statistical Reports[1] from the Arkansas Division of Elementary and Secondary Education from fiscal years 2006-07 to 2018-19 (covering the entire K-12 schooling of the 2019 graduating class in Arkansas). This dataset includes average per-pupil expenditures reported for each local education agency in Arkansas, including school districts, charter schools, and the Arkansas Virtual Academy.[2] Using the Consumer Price Index, we adjust the per-pupil expenditures to be in 2019 dollars. Then, we sum these per-pupil expenditures across the years a student is observed in Arkansas high school data to estimate the average cost of educating a student in each district based on historical spending. [3]

ROI Lifetime Earnings Data

The Arkansas Research Council estimates that an Arkansas resident with a bachelor's degree will earn $1,250,000 in a 30-year career (2016 dollars; $1,439,063 in CPI-adjusted 2019 dollars).[4] The Center on Education and the Workforce at Georgetown University estimated that nationwide, an individual who dropped out of high school will earn 57% less in lifetime wages, and an individual with no education beyond a high school degree will earn 43% less, compared to an individual who earned a bachelor's degree.[5] Therefore, we estimate the lifetime earnings of Arkansas residents to be $618,221 if they have dropped out of high school and $820,266 if they have graduated high school (in 2019 dollars). Our estimate for the lifetime earnings of a high school graduate will be very conservative because many students who graduate high school go on to attain more education. Therefore, our estimate of the ROI in Arkansas public schools will be conservative. However, this analysis is primarily concerned with the change in ROI that might result from implementing minimum grading. It is not clear how many students who would graduate high school because of minimum grading would go on to receive higher education. Therefore, to provide a conservative estimate of the increase in ROI from implementation of minimum grading, we assume those affected would not go on to attain higher education.

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[1] https://dese.ade.arkansas.gov/Offices/fiscal-and-administrative-services/publication-and-reports/annual-statistical-reports
[2] We exclude Arkansas School for the Blind, Arkansas School for the Deaf, and the Arkansas Division of Youth Services.
[3] We assume that a student resided in the same Arkansas district for their entire K-12 schooling and that they completed the first nine years of their schooling without skipping or repeating a grade. If a student no longer appears in the Arkansas data at some point after their freshman year, we assume they dropped out and do not include expenditures for that student in the remaining years after they disappear from our data.
[4] https://arc.arkansas.gov/arcweb/research/Arkansas_ESR_2018_summary.pdf
[5] https://cew.georgetown.edu/wp-content/uploads/collegepayoff-completed.pdf

Results

Minimum Grading Descriptive Trends

We first identify which students in our ninth-grade cohort would have been affected by a macro minimum grade policy implementation (Carey & Carifio, 2012). In Table 2 we show the grades that would have changed from failure to passing due to retrospective application of a minimum grade and the students affected.

Table 2

Percentage of Courses and Students Affected by Minimum Grade in Ninth Grade, FY16 Ninth-Grade Cohort

	Courses		Students	
	n	%	*N*	%
Total	315,013	100.0	32,894	100.0
Failed	20,569	6.5	7,806	23.7
Now Passing	4,570	1.4	3,178	9.7

Table 2 consists of two sections. In terms of courses, 315,013 total courses are taken by our ninth-grade student cohort. Among these, our ninth-grade students failed 6.5% of these courses. After generating a new variable limiting mid-quarter or mid-year grades to a minimum grade of 50, this changed 1.4% of course final grades, higher than Carey and Carifio's (2012) 0.3% final grades. About 24% of ninth-grade students in our sample failed at least one course in their ninth-grade year. Yet, when we recalculated their final grades after a minimum grade implementation, 9.7% of students were affected and earned a passing grade, similar to Carey and Carifio's (2012) 8.4% of students affected by a minimum grade implementation.

While some research on the importance of course grades during the ninth-grade year suggests that passing all courses during the ninth-grade year predicts that a student will graduate high school, other research suggests a less rigorous threshold, suggesting that even passing one additional course would put a student on track to graduate (Allensworth & Easton, 2017; Easton et al., 2017; Morris & McKenzie, 2024a). Therefore, we select two groups of interest for our analysis among those students in our sample that did not graduate high school: ninth-grade students who would pass at least one failed course under minimum grading, and ninth-grade students who would have passed all their courses in their ninth-grade year under minimum grading. Assuming that students in these two groups would go on to graduate high school under minimum grading, we provide a spectrum of estimated impact, with the estimated economic benefits following the success of the first group representing the broad bound estimate of the economic impacts of minimum grading and that of the second group representing the narrow bound estimates, or put another way, the conservative estimate. We provide the demographic and programmatic characteristics of all students in the cohort, students who did not graduate but would be affected by minimum grading under the broad bound, and the students who did not graduate but would be affected by minimum grading under the narrow bound in Table 3.

Table 3

Demographic and Programmatic Characteristics of Ninth-Grade Students Affected by Minimum Grading (by Broad and Narrow Bounds), FY16 Ninth-Grade Cohort

	Broad Bound		Narrow Bound		Total Cohort	
	N	%	*n*	%	*n*	%
Female	398	38.2	114	43.0	16,173	49.2
Male	644	61.8	151	57.0	16,721	50.8
White	593	56.9	170	64.2	21,209	64.5
Black	292	28.0	62	23.4	6,573	20.0
Hispanic	122	11.8	26	9.8	3,612	11.0
Other Races	35	3.4	7	2.6	1,500	4.5
FRL	839	80.5	197	74.3	19,051	57.9
GT	44	4.2	16	6.0	4,439	13.5
ELL	74	7.1	16	6.0	2,168	6.6
SPED	107	10.3	24	9.1	3,457	10.5
Total of Sample	1042	3.2	265	0.8	32894	100.0

In our sample, 3.2% of students in the cohort both would be impacted by the minimum grade policy under the broad bound but historically did not graduate high school, and 0.8% would be impacted under the narrow bound but historically did not graduate. Comparing the demographic and programmatic characteristics of these two group to the total sample reveals interesting patterns. The narrow bound group closely aligns with the broader sample regarding characteristics, indicating that these students are more representative of the overall ninth-grade population. However, one notable distinction emerges—the percentage of students receiving Free- or Reduced-Price Lunch (FRL), an indicator often used as a proxy for economic disadvantage, is significantly higher in both the broad and narrow bound groups than in the full sample, suggesting minimum grading would. This observation suggests that the narrow bound group, which reflects a more conservative representation of Arkansas's ninth-grade students.

Cost-Effectiveness

As shown in Table 4, in 2018-19 (the year that on-track students in this cohort graduated high school), the average cost to educate a student in this cohort statewide was $10,217. Using historical district-level expenditures back to 2006-07, we find that the average cost to educate a student in this cohort for their entire duration in Arkansas public schools was $137,976 (in 2019 dollars). We therefore estimate that the state of Arkansas spent $663,949,888 to educate 5,630 students (17.1%) in this cohort who did not graduate. However, when we simulate the impact of a minimum grading policy upon this cohort's graduation rates, we find that our narrow-bound estimate would lead to a reduction of $38,256,308 in the amount spent on non-graduating students, and the broad-bound estimate would lead to a reduction of $154,523,456 in the amount spent on non-graduating students. By increasing graduation rates, minimum grading, at its highest, would likely have increased Arkansas schools' cost-effectiveness by 23% and, at its lowest, by 6%. This contrast is visualized in Figure 1.

Table 4

State-Level Cost Effectiveness of Arkansas Public Schools with and Without Minimum Grading, FY16 Ninth-Grade Cohort

	Mean	Min	Max
FY19 Average Expenditure Per Student	$10,217	$647	$27,030
Avg. total cost to educate a Student from K5 to Exit	$137,976	$77,420	$351,391
Avg. total cost to educate all non-graduates, without MG	$663,949,888		
Avg. total cost to educate all non-graduates, with MG (NB)	$625,693,580		
Avg. total cost to educate all non-graduates, with MG (BB)	$509,426,432		
% decrease in cost to educate non-graduates (NB)	-5.8%		
% decrease in cost to educate non-graduates (BB)	-23.3%		

Note: MG = Minimum Grading, BB = Broad Bound, NB = Narrow Bound.

Figure 1

Change in Cost-Effectiveness (Total Cost to Educate Non-Graduating Students), FY16 Ninth-Grade Cohort

The concentration of students affected by minimum grading in their ninth-grade year varies across districts; in 50 of the 252 districts in our data, minimum grading would not affect passing rates at all, and therefore, we assume that high school graduation rates would not change. Consequently, we examined cost-effectiveness in 11 Arkansas school districts, listed anonymously in Table 5. This includes the top five districts in terms of concentration of students who would be affected under the broad bound and the top five in terms of the narrow bound (non-overlapping groups), as well as the only district that appears in the top 10 districts for both bounds (District K).

Table 5

State-Level Cost Effectiveness of Arkansas Public Schools With and Without Minimum Grading, FY16 Ninth-Grade Cohort

	N students in cohort	Cohort graduation rate	% affected by MG		FY19 avg. exp. per pupil	Avg. total cost to educate student	Avg. total cost to educate non-graduates			% decrease in cost to educate non-graduates	
			BB	NB			Without MG	With MG, BB	With MG, NB	With MG, BB	With MG, NB
District A	57	86.0%	8.8%	7.0%	$8,103	$120,866	$773,958	$145,376	$271,092	81.2%	65.0%
District B	79	83.5%	8.9%	3.8%	$9,906	$142,282	$1,568,586	$539,824	$1,127,688	65.6%	28.1%
District C	35	86.0%	8.6%	5.7%	$12,129	$132,882	$655,168	$254,367	$387,968	61.2%	40.8%
District D	95	73.7%	11.6%	3.2%	$9,391	$141,147	$2,855,933	$1,174,225	$2,397,285	58.9%	16.1%
District E	29	79.3%	10.3%	6.9%	$11,231	$149,101	$800,555	$340,982	$494,173	57.4%	38.3%
District F	33	72.7%	12.1%	3.0%	$9,725	$141,370	$1,114,832	$523,103	$966,900	53.1%	13.3%
District G	45	88.9%	4.4%	4.4%	$10,899	$153,047	$616,451	$299,035	$299,035	51.5%	51.5%
District H	70	74.3%	11.4%	1.4%	$15,379	$185,430	$3,063,535	$1,537,908	$2,872,832	49.8%	6.2%
District I	33	84.8%	6.1%	6.1%	$11,718	$151,960	$648,110	$336,213	$336,213	48.1%	48.1%
District J	241	72.6%	10.8%	0.8%	$12,812	$169,375	$9,883,250	$5,238,380	$9,525,952	47.0%	3.6%
District K	45	82.2%	6.7%	4.4%	$14,588	$191,441	$1,371,700	$780,262	$977,408	43.1%	28.7%

Note: MG = Minimum Grading, BB = Broad Bound, NB = Narrow Bound.

While we estimate that implementing a minimum grading policy would moderately increase the cost-effectiveness of Arkansas public schools in terms of expenditures on non-graduating students, the change in cost-effectiveness could be significant in these most affected districts. Among these top 10 most-affected districts, the percentage of students affected by minimum grading under the broad-bound conditions ranges from 9% to 18%, and under the narrow-bound conditions, 0.8 to 12%. The decrease in costs to educate non-graduating students ranges from 34% in District B to 66% in District J under the broad-bound conditions and from no change in District H to 38% in District G under the narrow-bound conditions. While these results do not imply that districts would save money, it does suggest that for some districts, implementing minimum grading could significantly impact graduation rates and, therefore, the cost-effectiveness of schools in terms of high school graduation.

Return on Investment

Next, we turn to the estimated long-term ROI from implementing minimum grading. At the state level, we find no change in Arkansas public schools' estimated ROI from implementing minimum grading (see Table 6). We estimate the wages earned by this cohort of students per dollar invested in their education to be approximately $5.80 with and without minimum grading (both for the broad and narrow bounds).

Table 6

State-Level ROI for Arkansas Public Schools, with and without Minimum Grading, FY16 Ninth-Grade Cohort

	Mean	Min	Max
Avg. total cost to educate a student from K5 to exit	$137,976	$77,420	$351,391
Avg. estimated lifetime earnings per student	$682,462	$537,000	$712,500
Total estimated lifetime earnings of cohort	$25,844,316,160		
Total estimated lifetime earnings of cohort, with MG (BB)	$26,054,846,464		
Total estimated lifetime earnings of cohort, with MG (NB)	$25,897,859,072		
Estimated ROI without MG	$5.80	$1.76	$10.57
Estimated ROI with MG (BB)	$5.80	$2.08	$10.95
Estimated ROI with MG (NB)	$5.79	$2.08	$10.95

Note: MG = Minimum Grading, BB = Broad Bound, NB = Narrow Bound. ROI estimates represent the dollars a student earns per dollar spent on their education.

We essentially find the same result at the district level (see Table 7), as any estimated change in ROI under minimum grading is minimal. For both the broad and narrow bounds, we estimate the change in ROI from minimum grading to be approximately 2% or less. In two districts (D and G), we estimate a very slight decrease in ROI due to the implementation of minimum grading. This is because the average cost to educate a student in their district for the additional years they would now spend in school, rather than dropping out, outweighs the estimated gains in lifetime earnings associated with graduating from high school.

Table 7

ROI in Top 10 Districts Most Affected by Minimum Grading, FY16 Ninth-Grade Cohort

	Avg. est. lifetime earnings per pupil			Avg. estimated lifetime earnings per cohort			Estimated return on investment			Increase in ROI	
	Without MG	With MG, BB	With MG, NB	Without MG	With MG, BB	With MG, NB	Without MG	With MG, BB	With MG, NB	With MG, BB	With MG, NB
District A	$791,909	$809,632	$806,087	$45,138,800	$46,149,028	$45,946,984	$6.58	$6.61	$6.62	0.5%	0.6%
District B	$787,018	$804,921	$794,691	$62,174,428	$63,588,744	$62,780,564	$5.54	$5.56	$5.54	0.3%	0.0%
District C	$791,402	$808,721	$802,948	$27,699,084	$28,305,220	$28,103,176	$5.96	$6.07	$6.03	1.9%	1.2%
District D	$767,096	$790,491	$773,477	$72,874,144	$75,096,640	$73,480,280	$5.49	$5.45	$5.48	-0.7%	-0.2%
District E	$778,464	$799,365	$792,398	$22,575,444	$23,181,580	$22,979,534	$5.22	$5.30	$5.28	1.6%	1.1%
District F	$765,163	$789,653	$771,285	$25,250,372	$26,058,552	$25,452,418	$5.42	$5.42	$5.43	0.0%	0.1%
District G	$797,817	$806,796	$806,796	$35,901,744	$36,305,836	$36,305,836	$5.24	$5.23	$5.23	-0.2%	-0.2%
District H	$768,312	$791,402	$771,198	$53,781,808	$55,398,168	$53,983,856	$4.14	$4.21	$4.15	1.9%	0.3%
District I	$789,653	$801,898	$801,898	$26,058,552	$26,462,644	$26,462,644	$5.19	$5.25	$5.25	1.0%	1.0%
District J	$764,934	$786,732	$766,611	$184,349,136	$189,602,304	$184,753,232	$4.52	$4.57	$4.53	1.0%	0.1%

Note: MG = Minimum Grading, BB = Broad Bound, NB = Narrow Bound.

Discussion

This study explored the potential financial impact of implementing a minimum grading policy in Arkansas public schools on cost-effectiveness and ROI. Minimum grading policies, which aim to reduce course failures among students, have garnered attention in education reform discussions. Our analysis focused on a cohort of ninth-grade students who would have been affected by such a policy, assessing the economic implications of this intervention.

The Grading Policy

Our findings indicate that minimum grading has the potential to impact student outcomes positively. When we applied a minimum grade to mid-semester or mid-year grades, we observed a change in 1.4% of course final grades from failing to passing, higher than figures previously found in other studies. Moreover, about 24% of ninth-grade students initially failed at least one course, highlighting this cohort's prevalence of academic struggles. However, after implementing minimum grading, 9.7% of these students would have passed a course they failed.

Proponents of minimum grading argue that implementing the grading policy would do more than pass a few students who would otherwise fail; it would contribute to increases in student motivation, primarily by maintaining a healthy locus of control within the student (Carifio & Carey, 2010). By offering students a second chance to succeed, minimum grading aligns with the idea that a healthy locus of control, where students feel they can influence their academic outcomes, plays a crucial role in their overall academic performance (Carifio & Carey, 2010). Based on this theory, minimum grading has the potential to benefit more students in our sample than we estimate. Nevertheless, our findings underscore the value of minimum grading as an equitable grading practice that can positively influence students' academic outcomes, and potentially their motivation and effort.

Cost-Effectiveness

We estimated that Arkansas spent $663,949,888 towards educating 17.1% of the cohort who did not graduate. Simulating the impact of a minimum grading policy on graduation rates presented the potential for significant cost savings. Under the narrow-bound estimate, the policy could reduce expenses by $38,256,308 for non-graduating students, while the broad-bound estimate projected an even higher reduction of $154,523,456. These findings indicate that minimum grading can potentially enhance Arkansas public schools' cost-effectiveness by 6% to 23%.

Of particular significance is the variation across school districts, where the concentration of affected students differs. In 50 of 252 districts, we estimate that minimum grading would not impact passing rates. However, in the most affected districts, where a higher percentage of students, especially those receiving Free- or Reduced-Price Lunch (FRL), would benefit from the policy, cost reductions could range from 34% to 66% under broad-bound conditions. This highlights the potential for substantial cost savings in districts with a greater proportion of students affected by minimum grading, thereby addressing equity concerns and supporting students facing challenging life circumstances. While the former researchers claimed savings of $2 million over seven years in a Massachusetts school district (Carifio & Carey, 2013), the actual financial impact can vary depending on local factors and implementation strategies. Therefore, the extent to which these savings are considered substantial may vary across districts.

Return on Investment

Our simulation estimated that the implementation of minimum grading would not yield a substantial change in ROI estimates at the state level. Whether the policy was applied under broad or narrow bounds, the ROI remained consistent. A similar pattern emerged when examining ROI at the district level, where we observed very minor fluctuations in ROI estimates. Two districts experienced a slight decrease in ROI because of implementing minimum grading. This outcome can be attributed to cost of the additional years students would spend in school rather than dropping out, impacting the investment more than the return.

These findings raise important considerations for districts contemplating implementing minimum grading policies. While minimum grading could increase cost-effectiveness, especially for districts with a higher proportion of students who may benefit from this policy, the long-term ROI likely would not. The policy addresses short-term financial considerations by improving graduation rates without additional costs. Still, minimum grading may not necessarily lead to substantial economic gains in the long run.

Limitations

Our study is subject to several limitations that should be acknowledged. First, variations in data reporting practices across different school districts and disparities in policies related to course recovery presented challenges in estimating potential cost reductions resulting from implementing minimum grading. Therefore, while there may be cost reductions associated with minimum grading, we are unable to estimate them. Second, due to the nature of our analysis, our study does not establish a causal relationship between implementing minimum grading and students' graduation outcomes, schools' cost-effectiveness, or students' ROI. While we estimate the potential impact of minimum grading on graduation rates through simulation, it is important to note that we cannot predict individual outcomes with certainty. Third, our analysis did not significantly reveal how minimum grading policies specifically affect underrepresented groups, such as students of color or economically disadvantaged students, due to the limited variability in demographic data within Arkansas. This is a major limitation as it restricts our ability to analyze equity implications deeply. Future studies might explore these dynamics in a state with a more diverse student population to provide a more detailed understanding of how such policies impact these important subgroups. Finally, our results are specific to the context of Arkansas, and consequently, the applicability of our findings to other states or regions with differing educational structures and demographics may be limited. It is essential to consider these contextual nuances when interpreting and applying our findings beyond the scope of Arkansas.

Conclusion

In conclusion, our findings suggest that minimum grading has the potential to positively impact student outcomes by offering struggling students a second chance to succeed. The minimum grading approach aligns with theories emphasizing the importance of student motivation in academic success. By providing students with opportunities for redemption, minimum grading could help them pass their courses and contribute to their overall academic well-being.

By simulating minimum grading implementation in Arkansas, we find this grading policy has the potential to lead to significant increases in cost-effectiveness, particularly in districts with a higher proportion of students who may benefit from this policy. However, our study shows that minimum grading did not yield substantial changes in ROI estimates. This

underscores the need for school districts to consider the trade-offs between short- and long-term financial benefits when adopting policies.

While minimum grading policies can be a valuable tool for promoting equity and supporting students who face challenges, districts should also recognize that their economic impact, as reflected in ROI, may not be transformative. Instead, they should consider minimum grading as one component of a broader strategy to improve educational outcomes and address student disparities. We recommend that policymakers and educators consider the implementation of minimum grading on the grounds of enhancing educational equity and reducing disparities, particularly in districts with diverse student populations, rather than on the grounds of economic benefits. Education is a complex and multifaceted endeavor influenced by various factors beyond grading policies, and the economic impact of minimum grading must be considered in the broader context of educational decision-making. Further research should explore the specific effects of minimum grading on different demographic groups to inform more targeted policy adaptations. Further research and empirical evidence will continue to shape our understanding of the role of minimum grading in education, providing valuable insights for policymakers, educators, and stakeholders in pursuing equitable and effective educational practices.

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