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Learner Engagement and Demographic Influences in Brazilian Massive Open Online Courses: Aprenda Mais Platform Case Study

Júlia Marques Carvalho da Silva ^{1,*}, Gabriela Hahn Pedrosa ¹, Augusto Basso Veber ¹
and Úrsula Gomes Rosa Maruyama ²

¹ Instituto Federal do Rio Grande do Sul, Bento Gonçalves 95700344, Brazil; gabriela.hahn@osorio.ifrs.edu.br (G.H.P.); augusto.veber@bento.ifrs.edu.br (A.B.V.)
² Ministério da Educação, Brasília 70047900, Brazil; ursulamaryama@mec.gov.br
* Correspondence: julia.silva@bento.ifrs.edu.br

Abstract: This paper explores the dynamics of student engagement and demographic influences in Massive Open Online Courses (MOOCs). The study analyzes multiple facets of Brazilian MOOC participation, including re-enrollment patterns, course completion rates, and the impact of demographic characteristics on learning outcomes. Using survey data and statistical analyses from the public Aprenda Mais Platform, this study reveals that MOOC learners exhibit a strong tendency toward continuous learning, with a majority re-enrolling in subsequent courses within a short timeframe. The average completion rate across courses is around 42.14%, with learners maintaining consistent academic performance. Demographic factors, notably, race/color and disability, are found to influence enrollment and completion rates, underscoring the importance of inclusive educational practices. Geographical location impacts students' decision to enroll in and complete courses, highlighting the necessity for region-specific educational strategies. The research concludes that a diverse array of factors, including content interest, personal motivation, and demographic attributes, shape student engagement in MOOCs. These insights are vital for educators and course designers in creating effective, inclusive, and engaging online learning experiences.



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1. Introduction

Massive Open Online Courses (MOOCs) represent a groundbreaking shift in higher education. Unlike traditional distance education, MOOCs are open to everyone without prerequisites, catering to a diverse range of students. As highlighted in [1], MOOCs stand apart from typical online courses because of their unique attributes. These courses are online, often free, and have made quality education accessible, overcoming geographical and financial constraints.

The theoretical underpinning of MOOCs draws from George Siemens' connectivism theory [2]. This challenges traditional teaching and learning structures that depend on classroom interactions. As noted in [2,3], MOOCs are a natural progression in the realm of open teaching and learning.

MOOCs differ from conventional online courses in two key ways [4]: (i) open access—they are available to anyone interested and should be free; (ii) scalability—they accommodate an unlimited number of participants.

MOOCs are noted for being free and supportive of various students, as well as being easy to manage, requiring only a teacher [5]. Hosted on platforms that can handle high traffic, these courses use forums, presentations, and tests to evaluate student learning.

According to [6], MOOCs operate on four core principles: autonomy, diversity, openness, and interactivity. This ensures that students can direct their own learning and gain from a range of perspectives within the course. Some MOOCs mirror traditional teaching models, with the teacher playing a central role, and can complement face-to-face teaching.

In recent times, a variety of MOOC providers have emerged, established by public and private educational institutions, corporations, and non-profits. Examples include Udacity, edX, Udemy, Khan Academy and Coursera (USA), Open2study (Australia), Alison (Ireland), Miríada (Spain), Future Learn (UK), Fun (France), Iversity (Germany).

Brazil has ramped up its investment in government programs that promote the use of Information and Communication Technologies (ICTs) in classrooms, particularly in distance education, to tackle social inequality and enhance access to education. These public investments have not only facilitated a range of courses and training pathways but also spurred the development of educational resources, increasing the capacity for distance learning in public institutions.

Despite MOOCs' potential, they struggle with keeping engagement and completion rates high. The diversity of participants, varying in motivation and commitment levels, poses challenges but also offers opportunities for rich, multicultural learning environments. MOOCs' influence reaches beyond individual learning, affecting traditional educational structures and policies. Future directions for MOOCs might involve more blended learning methods and a stronger emphasis on certifying and accrediting learning, thus boosting their value in professional and academic settings [7–10].

In this study, we examined various factors to understand their impact on students' educational journeys in Brazilian public education. The first set of factors was socio-demographic, including income, race/color, disability, and geographic location. Income was divided into different categories to reflect students' economic backgrounds. Race/color was considered in assessing the role of racial and ethnic diversity in educational participation. Disability status was included to explore its impact on students' educational pathways. Geographic location, distinguished as 'urban' or 'rural', was analyzed to identify disparities in educational opportunities between these areas.

The second set of factors is related to educational aspects, like initial course grades and enrollment in—and completion of—subsequent courses. Initial grades were studied to determine if academic performance influences further education enrollment. Enrollment in subsequent courses was a key indicator of students' commitment to continuing their education.

The study focused on the Aprenda Mais Platform [11], which surpassed 1 million enrollments in 2023. We examined course completion rates to understand patterns in educational persistence and success. These factors together offered a comprehensive view of the various elements influencing students' educational choices, providing a detailed analysis of how diverse backgrounds and experiences shape their pursuit of further education.

2. Similar Studies

We have some papers that apply to our study. Certain ones concentrate on the sociodemographic information of the students. The student's path through a course is more interesting to others. We present and discuss several studies to inform our research.

MOOCs represent a significant innovation in distance education, offering scalable and accessible learning opportunities. However, high attrition rates and varied learner engagement patterns pose challenges for course designers and educators. Understanding the nuances of a student's behavior is crucial to enhancing MOOC efficacy and student outcomes.

Ref. [12] highlights the student base, which is female and Spanish-speaking, driven by professional growth. However, completion rates were less than 14%, showing a need for strategies to improve engagement and course completion. Another study [13] shows that diversity statements can have a positive impact on enrollment behavior, especially for lower-SES students, emphasizing signifying inclusive language in MOOC platforms. The

implications for MOOC design are significant in both studies. To create course content that is more relevant and engaging, it is essential to grasp the demographics and motivations of the students. Incorporating diversity statements and inclusive language in MOOCs can attract a wider array of learners. Researchers should concentrate on enhancing completion rates and delve into how various aspects of course design impact learners from diverse backgrounds. In their thorough analysis of user progression across 16 Coursera courses, ref. [14] explored different approaches to accessing course content, including sequential and user-driven methods. They looked at various metrics of learner outcomes and milestones, uncovering trends in student engagement and dropout rates. This shed light on the non-linear ways students consume course material.

Ref. [15] focused on four edX-based MOOCs to see if learners followed the designed learning paths. They employed three analytical methods: video interaction graph, behavior pattern chains, and type transitions. Their study found significant differences between planned and actual learning paths and highlighted varying behaviors of successful and unsuccessful learners.

Using EPM on system logs from a FutureLearn MOOC, ref. [16] analyzed how learners allocated their time to different activities. The study differentiated between those who completed and those who did not, uncovering distinct participatory behaviors and time-based learning patterns within these groups.

Ref. [17] conducted a study similar to ours, linking sociodemographic data to MOOC engagement. They focused on how learners' navigation strategies varied based on demographics like age and country of origin. Analyzing the behavior of 140,546 students across edX MOOCs, the study found that those who earned certificates often skipped 22% of the content and navigated non-linearly, such as revisiting earlier lectures. It noted that older students and those from countries with lower student–teacher ratios navigated more thoroughly and non-linearly.

The research by [17] used data from four courses offered by MIT, Harvard, and UC Berkeley in the fall of 2012. They collected demographic information like age, education level, gender, and country of origin from students who registered for a free edX account. These data, along with other variables such as certificate achievement, grades, content coverage, and forum participation, were used to analyze navigation strategies and motivations. The study concluded that, despite the linear structure of xMOOCs, students navigated in a non-linear fashion. However, younger students and those from countries with higher student–teacher ratios stuck more closely to the instructor-provided structure.

Therefore, ref. [17] suggests that MOOC platforms should offer more flexibility to accommodate various learning strategies and motivations. They also note that the results are based on log data, which might not reflect the students' actual motivations or knowledge acquisition.

3. Materials and Methods

3.1. Methodology

A case study delves into a contemporary phenomenon (the “case”) within its real-life context, particularly when the distinction between the phenomenon and its context is not very clear [18]. Data triangulation is crucial in addressing this unique technical challenge, allowing for a blend of qualitative and quantitative research methods [19–21].

The case study method is versatile and used across various fields to enhance our understanding of individual, group, organizational, social, political, and other phenomena. However, it is important to recognize that case studies, similar to experiments, are generalizable to theoretical propositions rather than to populations or entire universes [18]. It is essential to understand that a case study, much like an experiment, does not serve as a “sample” of a larger population. Instead, its purpose is to expand and generalize theories (analytical generalization), not to deduce probabilities (statistical generalization).

Our analysis used several statistical techniques to examine the connections between various sociodemographic factors and students' educational paths. These included logistic regression, analysis of variance (ANOVA), and chi-square tests [22]:

Logistic regression was employed to assess the relationships between continuous or categorical independent variables and a binary dependent variable. In our study, this method proved useful in evaluating how factors like initial course grades and demographic characteristics (such as race/color and disability) affected the probability of students enrolling in further courses. Logistic regression calculates the odds ratio for each predictor, shedding light on the strength and direction of these relationships [22]. For example, a positive coefficient shows a higher likelihood of course enrollment with an increase in the predictor variable, whereas a negative coefficient implies the reverse.

ANOVA was used to compare the means of a dependent variable across various groups. In our study, this technique helped to examine how different income levels, categorized into distinct groups, influenced students' decisions to enroll in subsequent courses. ANOVA was crucial in determining if the mean differences between income groups were statistically significant. This method is useful for handling categorical independent variables with over two levels, as it allows for analyzing variance within and between these groups.

Chi-square tests were used to explore the relationship between two categorical variables. This method was key in determining whether the observed frequencies in different categories (such as 'urban' or 'rural' geographical locations) differed significantly from the expected frequencies. In our analysis, chi-square tests were effective in uncovering significant links between students' geographical locations and their choices to pursue further education. This test is especially apt for nominal data and clearly shows whether there is an association or independence between variables.

Each of these statistical techniques contributed valuable insights into the factors shaping students' educational trajectories. Logistic regression provided an in-depth view of how various factors affected the likelihood of enrolling in more courses. ANOVA enabled us to compare average enrollment rates across different income groups. Finally, chi-square tests offered a straightforward way to examine the relationships between categorical variables such as location and educational decisions. Collectively, these methods formed a robust analytical framework, allowing for a comprehensive understanding of the complex nature of students' educational choices.

The analysis of factors such as income, disability, race/color, and geographic location in MOOCs is of paramount importance for various reasons:

1. **Income and Accessibility:** While MOOCs are often low-cost or free, appealing to learners from diverse income backgrounds, an analysis of income levels is crucial to identify disparities in access to the necessary technology and internet connectivity. This is vital in addressing the digital divide and ensuring that MOOCs are genuinely inclusive, especially for those who could benefit most from these educational opportunities.
2. **Disability and Inclusivity:** Assessing disability in MOOCs is critical to enhance accessibility. MOOC platforms and course content should adhere to universal design principles, making them accessible to individuals with various physical and learning abilities. This approach is not just fair but also widens the potential learner base, positioning MOOCs as a more universally beneficial educational resource.
3. **Race/Color and Representation:** Analyzing race and color in MOOC participation helps understand representation issues and the cultural relevance of course content. Knowing the racial and ethnic makeup of MOOC learners can inform the creation of more inclusive and diverse materials, resonating with a wider audience and identifying potential barriers faced by learners from different racial backgrounds, such as language or cultural nuances.
4. **Geographic Location and Learning Context:** The geographic location of learners, whether from urban or rural areas, developed or developing countries, significantly affects their learning context. Analyzing these variations can provide insights into regional educational needs, internet access, and cultural factors affecting MOOC

engagement and success. Adapting MOOCs to accommodate these geographic differences can make them more effective and far-reaching.

5. Performance and Student Path Data: Student performance indicators, particularly “Initial Course Grades”, are crucial. These initial grades help analyze the relationship between academic performance and the likelihood of enrolling in further courses. “Enrollment in Subsequent Courses” is a vital metric reflecting a student’s choice to continue their education. This enrollment symbolizes more than just signing up for additional classes; it has a tangible sign of a student’s enduring commitment to their academic path. Last, the “Completion of Subsequent Courses” goes beyond enrollment, examining whether students not only join but also accomplish these courses. This completion rate is key to understanding educational persistence and achievement, providing insights into how students maintain their academic endeavors.

We used Python libraries to conduct the statistical analyses. It handled data manipulation, statistical testing, and document creation. Pandas library helped with the data manipulation and analysis, providing robust tools for processing and analyzing the datasets. Statsmodels library provided advanced statistical testing, including logistic regression and analysis of variance (ANOVA). Lastly, Scipy library conducted chi-square tests.

3.2. Aprenda Mais Platform

The Aprenda Mais Platform is a significant Brazilian educational initiative launched by the Ministry of Education, featuring Massive Open Online Courses (MOOCs). The pedagogical content is provided by the Federal Institute of Education, Science, and Technology of Rio Grande do Sul (IFRS), with technological support from the National Network for Teaching and Research (RNP).

Since its inception in 2020, the Aprenda Mais Platform (Figure 1) has grown to offer 240 courses, reflecting its commitment to sharing the quality and credibility of courses offered by the Brazilian Federal Network for Professional, Scientific, and Technological Education [23–25]. The platform aims to increase enrollment in online courses, reduce costs for institutions already offering such courses, and decrease the time needed to organize and launch alternative courses for institutions without an existing MOOC platform.

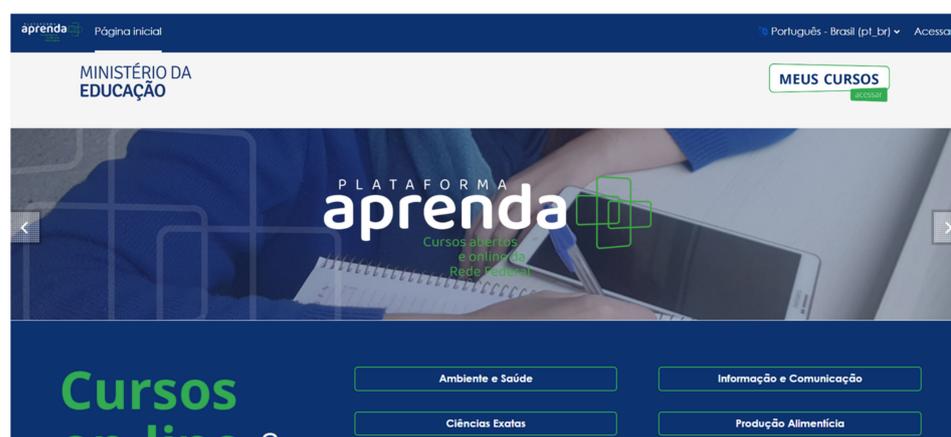


Figure 1. Aprenda Mais landing page.

The Brazilian Federal Network for Professional, Scientific, and Technological Education [23] comprises institutions renowned as educational benchmarks, closely integrated with the communities in their regions. These institutions boast extensive physical infrastructure, including laboratories, high-tech equipment, libraries, and sports facilities. They offer a wide range of educational levels, including technological professional education, secondary education, and undergraduate and postgraduate studies. They are recognized for their autonomy in applied research and community partnerships with the productive

sector. Presently, the Brazilian Federal Network encompasses over 1.5 million registrations and over 97,000 professionals, including faculty and administrative staff [26].

In this framework, the Aprenda Mais Platform's architecture, developed on Moodle, has been tailored to meet the specific requirements of the Brazilian Federal Network's MOOCs. To ensure user privacy and security in these self-instructional, short-duration courses, certain features like displaying student information have been disabled. The platform prioritizes accessibility, adapting or removing functionalities that cannot meet accessibility standards, offering an inclusive learning environment for people with diverse disabilities. Studies [27,28] also describe the importance of accessibility in MOOC platforms.

Figure 2 presents a screenshot of Aprenda Mais Platform, emphasizing its accessibility features. The page displays a video tutorial on creating YouTube captions, demonstrating the platform's commitment to inclusivity. A window in the bottom right corner shows a sign language interpreter, providing Brazilian Sign Language (Libras) support for the deaf and hard of hearing. Below the video, there is a text box titled 'Video Transcript', which caters to people who are blind or visually impaired by offering a text-based version of the video's content. These features highlight the platform's dedication to making education accessible to all learners, regardless of their sensory abilities.

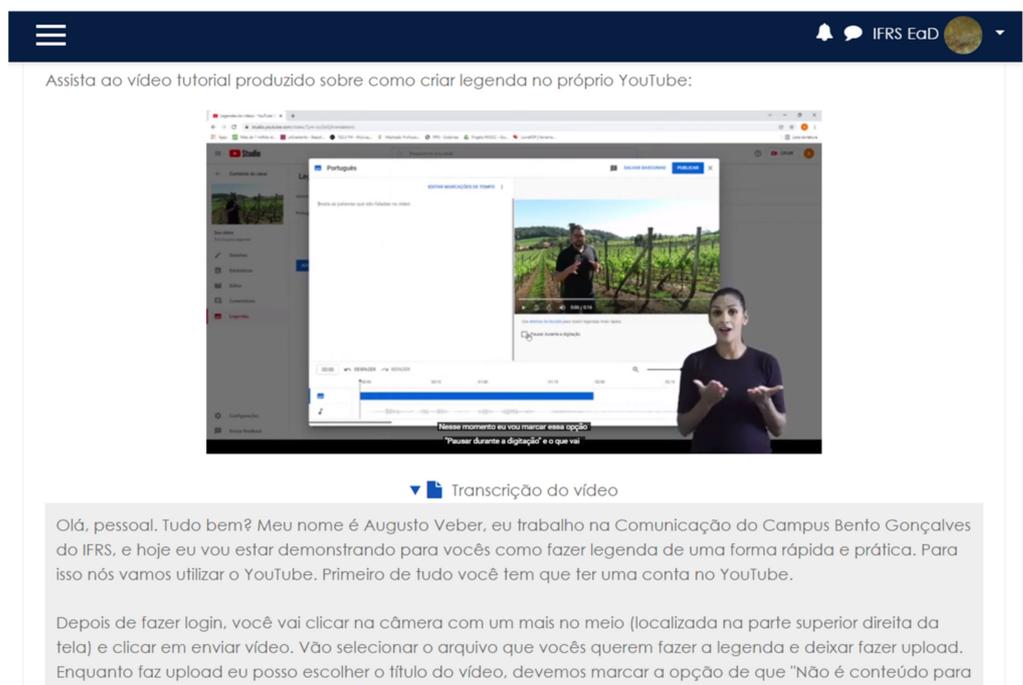


Figure 2. Aprenda Mais accessibility features.

Given the large scale of these courses, traditional tools such as forums and assignments, usually suited for smaller learning environments, have been excluded from streamlining course management, and improve the student experience. In response to this challenge, the course content at Aprenda Mais Platform is crafted to cater to a diverse audience. This inclusive approach is clear in the platform's access across various devices such as computers, tablets, and, most notably, smartphones. Remarkably, most learners access the platform via their mobile phones, primarily through mobile data connections. This usage pattern highlights a significant point: many students do not have access to high-speed internet at home.

This reality underscores the critical importance of content presentation choices. At Aprenda Mais Platform, there is a deliberate emphasis on text and image-based content. This strategy ensures that the core learning materials are accessible to all, regardless of their internet connectivity. Videos, while an effective educational tool, are relegated to a

supplementary role. This approach is mindful of students who may be disadvantaged by limited internet capacity, which is not only a reality in Brazil but worldwide [29–31].

Despite the reliance on less interactive content forms, like texts and images, Aprenda Mais Platform is committed to creating an engaging and motivating learning environment. The content is thoughtfully designed to captivate and maintain the interest of students, fostering an immersive educational experience. Ref. [32] confirmed that the quality of course design is an enormous factor in MOOCs. By prioritizing accessibility and inclusivity in content delivery, Aprenda Mais Platform not only accommodates the varied technological realities of its students but also upholds its commitment to educating a diverse learner base.

The design of the Aprenda Mais Platform, using the “Academi” theme, has been tailored to align with the “Digital Government Standard” and the “Use of the Federal Government Brand”. Its responsive layout ensures the platform is easily accessible and functional across various devices, ranging from desktops to mobile devices, enabling efficient usage by a diverse audience.

The platform categorizes its courses into 12 distinct areas, mirroring the technological axes and key knowledge domains defined by the Brazilian Federal Network. These courses primarily focus on basic, technological, and professional education. The platform serves as an ideal entry point for learners looking to venture into new fields or expand their knowledge in existing areas. Course durations vary, typically ranging from 20 to 60 h, and are structured into semester periods.

Course selection on the platform is strategically oriented around the priority themes of the Brazilian Federal Network, ensuring the relevance and timeliness of the content of Brazil’s educational requirements. Various institutions contribute to enhancing the quality and diversity of the course offerings, spanning multiple subjects from technology to the humanities. The courses are composed of texts, images, and videos, structured into modules, with evaluations at the end of each module through tests, reinforcing the learning process.

To successfully complete a course, students are required to finish all activities and achieve a minimum average grade of 60%. This assessment framework ensures that students receive the knowledge and skills for certificate eligibility. Once a course is successfully completed, students can request their certificates. The platform specifies a minimum deadline for certificate issuance, providing sufficient time for students to understand the material and show their competency in the subject area.

3.3. Our Study Data

This analysis of student enrollment and completion patterns in subsequent courses between September 2021 and August 2023, involving 998,657 enrollments in 220 courses, offers crucial insights into student behavior along their educational paths. Various variables were scrutinized to understand their impact on students’ decisions to enroll in and complete additional courses:

1. **Income:** Students’ income levels were categorized into various groups, such as ‘Up to 0.5 minimum wage’, ‘0.5 to 1 minimum wage’, and ‘Above 3.5 minimum wages’, among others. This categorization should reflect the economic backgrounds of the students and assess how this factor influences their educational choices.
2. **Race/Color:** Students’ racial or ethnic backgrounds were identified, with categories including ‘White’, ‘Black’, ‘Brown’, and others. This segmentation was crucial to investigate the role of racial and ethnic diversity in educational participation and engagement.
3. **Disability:** This variable identified students with disabilities, offering insights into how physical or mental challenges might influence their educational journeys. Understanding the experiences of these students is key to creating more inclusive educational environments.

4. **Geographic Location:** The location of students was classified as 'urban' or 'rural', based on the Brazilian capitals' list. This helped to discern the differences in educational opportunities and preferences between urban and rural settings.
5. **Initial Course Grades:** The grades achieved by students in their initial courses were analyzed to explore the relationship between academic performance and the likelihood of enrolling in further courses. This could show whether initial success or struggles impact students' decisions to continue their education.
6. **Enrollment in Subsequent Courses:** This crucial dependent variable showed whether students pursued additional courses after completing their initial course.
7. **Completion of Subsequent Courses:** Beyond enrollment, the completion of these subsequent courses was also scrutinized. This was essential to understanding patterns in educational persistence and achievement, offering insights into how students sustain their efforts and succeed in further courses.

Collectively, these variables provide a comprehensive view of the factors influencing students' decisions and behaviors in MOOCs, contributing significantly to understanding and enhancing the effectiveness of online education.

The selection of each variable in this study was strategic, aimed at testing specific hypotheses about educational trajectories:

1. **Socioeconomic Status Impact:** By categorizing students into different income levels, the study aimed to explore how socioeconomic status affects educational choices. This approach sought to understand if and how financial constraints influence a student's ability to access and engage with further education.
2. **Racial and Ethnic Influences:** The inclusion of the race/color variable allowed the analysis to delve into how racial and ethnic backgrounds impact educational participation. This investigation was crucial to understand whether certain racial or ethnic groups face unique challenges or advantages in the educational landscape.
3. **Geographic Disparities:** Including geographic location as a variable aimed at revealing disparities in educational access and preferences between urban and rural settings. This was vital in understanding how location influences the availability of educational resources and the willingness or ability of students to engage in further education.
4. **Academic Performance and commitment:** The analysis of initial course grades provided insights into whether academic performance could be a predictor of commitment to further education. It explored the possibility that higher initial grades might correlate with a greater likelihood of enrolling in and completing subsequent courses.

Collectively, these variables offered a comprehensive view of the multitude of factors potentially influencing students' educational decisions. This allowed for an in-depth analysis of the complex dynamics at play in students' pursuit of further education. Understanding the interplay of these variables was essential to grasp the multidimensional nature of education, particularly how diverse backgrounds and experiences shape educational trajectories in an online learning environment.

4. Results and Analysis

4.1. Preliminary Findings

The analysis of student re-enrollment and course completion patterns yields several insightful observations:

1. **Re-Enrollment Timing:** Students typically re-enroll in subsequent courses relatively quickly after completing an initial course. A significant majority do so within 30 days, with noticeable enrollments also occurring within 91–180 days and 181–365 days. On average, students take about 119.75 days to enroll in another course following the completion of a previous one. This timeframe varies widely, from immediate re-enrollment on the same day to as long as 781 days.

2. Subsequent Course Enrollment and Completion: On average, students enroll in about 8.03 courses, with a completion rate hovering around 42.14%. This suggests a moderately high level of engagement in continuous learning.
3. Academic Performance: The average initial course grade across all students is 82.35. Notably, students who complete subsequent courses have a marginally higher average initial grade (82.38) than those who enroll but do not complete them (81.99). The average grade in subsequent courses (82.11) is slightly lower than in the initial course, showing a consistent level of academic performance throughout their educational journey.
4. Enrollment in Subsequent Courses: A high percentage (88.52%) of students enroll in subsequent courses, while 11.48% do not engage in any further courses. These data show a strong inclination towards continuous learning among most of the student body.
5. Popular Initial and Subsequent Courses: Certain initial courses, such as 'Inglês 1' (English 1), 'Aprendizagem Significativa' (Significant Learning), and 'Administração Financeira' (Financial Administration), have proven effective in motivating students to enroll in subsequent courses. For subsequent courses, 'Inglês 1', 'Psicologia da Aprendizagem' (Psychology of Learning), and 'Espanhol 1' (Spanish 1) are among the most popular.

These findings show robust engagement among students in continuous learning and suggest that language and skill-based courses play a significant role in encouraging further educational pursuits. The data also reveal a general tendency among students to maintain a consistent academic performance level throughout their courses.

4.2. Hypothesis

H1: *Demographic characteristics, specifically, race/color and disability, have a significant relationship with the enrollment and completion of subsequent courses.*

The recent focus in educational research on understanding what influences students' decisions to enroll in and complete subsequent courses led to the hypothesis that demographic characteristics, specifically, race/color and disability, significantly affect these decisions.

To examine this hypothesis, two primary statistical methods were used: chi-square tests for categorical variables and multivariate logistic regression. The chi-square tests aimed to explore the association between race/color, disability, and the likelihood of enrolling in subsequent courses. Following this, a multivariate logistic regression model was developed to provide a deeper understanding of these relationships, considering multiple demographic variables.

Chi-square test results showed a statistically significant association between race/color and disability with course enrollment. *p*-values were notably low, signifying a strong relationship between these demographic factors and the likelihood of enrolling in additional courses.

Multivariate logistic regression analysis provided further insights. It found that variations in race/color positively correlated with the likelihood of enrolling in subsequent courses, as shown by a coefficient of 0.0535. This positive coefficient implies that students of certain racial or color groups have a higher probability of enrolling in further courses compared to others, depending on how these categories are numerically coded. Similarly, a disability was positively associated with subsequent course enrollment, as evidenced by a coefficient of 0.1963.

These findings significantly contribute to the ongoing discussion about educational accessibility and diversity. The positive correlation between race/color and course enrollment could show increased educational engagement among certain racial groups, or it may point to socioeconomic factors playing a role in educational opportunities. Likewise, the positive

association between disability and course enrollment shows the critical need for inclusive educational practices and policies. This underlines the importance of understanding and addressing the diverse needs of all student groups to ensure fair access to education.

H2: *There is a significant relationship between a student's income level and their likelihood of enrolling in subsequent courses following initial educational engagements.*

This study posited that a student's income level significantly impacts their likelihood of enrolling in subsequent courses after initial educational engagements. To test this hypothesis, a dual-method statistical approach was employed, using both analysis of variance (ANOVA) and logistic regression, tailored to analyze the categorized income data.

The income data, segmented into various groups such as "Up to 0.5 minimum wage", "0.5 to 1 minimum wage", and "Above 3.5 minimum wages", among others, were well-suited for ANOVA. This method aimed to determine whether there were statistically significant differences in the rates of continuing education enrollment across different income levels.

The results from the ANOVA were telling, providing robust support for the hypothesis. A notably low p -value (3.52×10^{-31}) showed significant differences in subsequent course enrollment rates among the various income categories. This outcome suggested that income level plays a critical role in influencing a student's decision to engage in further education.

Further elucidation came from the logistic regression analysis, which corroborated the ANOVA findings and provided deeper insight into the complex relationship between income levels and positing education. With income treated as a categorical variable in the logistic regression model, significant coefficients were observed, further affirming the impact of income on the decision to continue education.

In summary, the study's findings underscore a distinct pattern: students from lower-income groups were more inclined to enroll in subsequent courses. This tendency was especially pronounced in the lowest income categories, namely, "Up to 0.5 minimum wage" and "0.5 to 1 minimum wage". This suggests that students with lower incomes may view additional education as a critical avenue for improving their economic status and expanding their social opportunities, highlighting the role of education as a key factor in social and economic mobility.

H3: *Geographical location, specifically, whether students live in an urban area or a rural area, significantly impacts their decision to enroll in and complete subsequent educational courses.*

The study investigated the hypothesis that a student's geographical location, specifically, whether they live in an urban or rural area, significantly influences their decision to enroll in and complete additional educational courses. This was hypothesized because access to educational resources, cultural differences, and economic opportunities vary between urban capitals and rural regions, which could affect educational motivations and choices.

To evaluate this hypothesis, the chi-square test of independence was used, a fitting statistical method for examining the relationship between two categorical variables. Here, these variables were geographical location (categorized as 'urban' or 'rural') and the enrollment or completion of subsequent courses.

The results from the chi-square analysis showed a statistically significant disparity in course enrollment and completion rates between students in urban and rural areas. The chi-square value stood at 7.4004, with a p -value of 0.0065, signifying a significant correlation between geographical location and educational engagement. To further interpret these findings, average enrollment rates in subsequent courses for each group were calculated. It was found that about 55.84% of students from rural areas enrolled in subsequent courses, in contrast to 51.21% of students from urban areas.

These results imply that students living in rural areas are more inclined to pursue further education through subsequent courses than their urban counterparts. This trend

may reflect different motivations and necessities for educational advancement, potentially driven by socioeconomic factors, resource accessibility, or regional educational opportunities. The higher enrollment rates in rural areas could show a stronger necessity or aspiration for educational progress, possibly because of limited local opportunities or a desire for socioeconomic improvement.

These insights are vital for shaping educational policy and program design, emphasizing the importance of customizing educational offerings and support to meet the diverse needs of geographical populations. This understanding helps ensure that educational strategies are inclusive and effectively address the unique challenges and opportunities presented by different geographic settings.

H4: *Students with higher grades in their initial course are more likely to enroll in subsequent courses.*

To assess the hypothesis regarding the impact of initial course grades on enrollment in subsequent courses, logistic regression analysis was employed. This statistical method is effective in analyzing relationships between a continuous independent variable (in this case, the final grade in the initial course) and a binary dependent variable (whether a student enrolls in subsequent courses).

The logistic regression model revealed an intriguing finding: a negative coefficient for the initial course grade (-0.0144), which was statistically significant, as shown by a p -value close to zero. This negative coefficient suggests an inverse relationship between the grade in the initial course and the likelihood of enrolling in subsequent courses. The model's intercept was calculated at 3.24, showing the log odds of enrolling in a subsequent course when the initial course grade is zero.

Contrary to the initial hypothesis, the analysis shows that students with higher grades in their initial course are less likely to enroll in subsequent courses. This result is counterintuitive, challenging the conventional assumption that higher academic achievement typically encourages continued educational engagement.

These findings invite a re-evaluation of the factors that influence students' decisions to pursue further education. Elements other than academic performance, such as the relevance and appeal of course content, personal interests, or external commitments, might have a more pronounced influence on these decisions.

This study opens new pathways for further research. It highlights the need to delve deeper into understanding what motivates students, particularly those who achieve higher grades, to continue or discontinue their educational journey. This insight is crucial for developing more effective educational strategies and support systems that resonate with the diverse needs and aspirations of students.

H5: *Students choose subsequent courses in different areas of knowledge compared to their initial courses.*

To verify the hypothesis focusing on course categorization and its impact on student choices, a categorical analysis was conducted. The primary dataset comprised detailed information about courses, including their names and completion status, for both initial and subsequent courses. A secondary dataset categorized these courses across various knowledge areas. These datasets were merged, aligning course names to ensure accurate category associations. A chi-square test of proportion was then used to compare the rates of enrollment in courses within the same category versus different categories.

The analysis yielded significant results: 31.96% of students enrolled in subsequent courses within the same category as their initial courses. However, a notable majority, 68.04%, chose courses in different categories. The chi-square test resulted in a p -value of 0.0, showing that these differences in proportions were statistically significant.

These findings strongly support the hypothesis and highlight a distinct pattern in student behavior. The prevalent trend of students enrolling in courses across various areas

of knowledge suggests an inclination towards a diversified educational experience. This preference for diversification in course selection may reflect students' desire to attain a broader educational scope, which is vital for interdisciplinary learning and cultivating a comprehensive skill set.

These insights are valuable for guiding educational institutions in their course-offering strategies and in counseling students. Understanding this trend towards diversification can help institutions promote a more holistic educational approach, encouraging students to explore and integrate knowledge from various disciplines. This approach might lead to a more well-rounded educational experience, preparing students for the complexities and interconnectedness of the modern world.

5. Discussion

The synthesis of findings from various studies provides a detailed understanding of learner engagement and diversity in Massive Open Online Courses (MOOCs). Each study contributes to a deeper insight into student behaviors, motivations, and demographic factors that influence course enrollment and completion.

One key observation is the strong inclination among MOOC learners towards continuous learning. Students often re-enroll in subsequent courses shortly after completing an initial course, with an average re-enrollment time of approximately 120 days. There is a consistent completion rate of approximately 42.14% and a high average grade (approximately 82%). These statistics show not only a commitment to ongoing education but also a consistent level of academic performance across various courses. This commitment aligns with the high enrollment rates observed in some studies, where most learners enrolled in an MOOC for the first time, driven by interests in course content and professional development.

The hypothesis regarding the influence of demographic characteristics like race/color and disability on enrollment and completion rates is substantiated by the findings. The positive correlation between these demographics and enrollment implies that certain groups are more engaged in MOOCs, potentially because of socioeconomic factors or educational opportunities. The positive association between disability and course enrollment also highlights the necessity of inclusive educational practices. This supports the results from studies showing that inclusivity, such as through a diversity statement, can positively impact enrollments from lower socioeconomic status (SES) groups.

Geographical location also plays a significant role in educational decisions. Students from different locations, whether urban capitals or rural areas, show varying enrollment and completion rates in subsequent courses, reflecting disparities in access to educational resources and economic opportunities.

Contrary to initial expectations, the study finds that students with higher grades in their initial course are less likely to enroll in subsequent courses. This suggests that factors like course content and personal interest may be more influential than academic performance in decisions to continue education. This finding may reflect the gap between high initial expectations for MOOC completion and the actual completion rates observed in some studies.

The tendency of students to enroll in a diverse range of courses shows a preference for a broad educational spectrum, crucial for interdisciplinary learning and skill development. This pattern of seeking varied educational discoveries points to a desire among learners for a more comprehensive educational approach.

On the course design side, the significant influence of race/color and disability on enrollment decisions emphasizes the critical need for inclusivity in course design and delivery. Educators and MOOC providers must ensure that courses are accessible and relevant to a diverse student population, considering the varied learning needs and backgrounds. This extends beyond mere compliance with accessibility standards to a more profound commitment to inclusive education, which reflects the diverse tapestry of Brazilian society.

The pattern of higher enrollment among lower-income students highlights MOOCs as powerful tools for social and economic mobility. This underscores the responsibility of educational providers to ensure that these courses are not only accessible in terms of cost but also relevant to the career and life aspirations of these students. MOOCs have the potential to bridge educational gaps and offer pathways for advancement to those who might otherwise lack access to such opportunities.

Furthermore, the geographical disparities in educational engagement between urban and rural students underscore the need for targeted strategies to address these differences. MOOCs, with their inherent flexibility and reach, can play a pivotal role in bringing quality education to remote areas, thus democratizing learning access.

In summary, these insights from various studies offer valuable guidance for MOOC providers and educators. Understanding these patterns and influences can help in tailoring MOOC offerings to meet the diverse needs and motivations of learners, ultimately enhancing the effectiveness and reach of online education.

6. Conclusions

This analysis unveils an unexpected trend: students with higher grades in their initial courses are less likely to engage in subsequent courses. This observation challenges the traditional notion that academic success is a primary driver for continued educational endeavors. It suggests that students excelling academically might feel content with their current educational achievements or have different priorities, emphasizing that educational motivation is multifaceted and not solely dependent on academic performance.

The study also brought to light the significant influence of race/color and disability on enrollment decisions. Students with disabilities and those from certain racial or ethnic backgrounds were more inclined to enroll in additional courses. This finding shows the importance of inclusive educational policies and practices, underscoring the need for educational systems to accommodate and cater to the diverse needs of students. It shows the varied landscape of student requirements and the necessity of tackling educational disparities to ensure fair access for all.

Another critical observation was the higher likelihood of lower-income students enrolling in subsequent courses. This pattern shows that students from less affluent backgrounds might view continued education to improve their economic and social prospects. This insight underscores the importance of providing financial and educational support to lower-income students, ensuring fair access to ongoing learning opportunities.

The study found that students from rural areas were more likely to enroll in and complete subsequent courses compared to their urban counterparts. This difference suggests varying educational needs and access among students from different geographical locations, likely reflecting disparities in the availability of educational resources and opportunities. This finding is crucial for shaping educational strategies and policies, highlighting the need to consider geographical disparities in planning and resource allocation.

For MOOC providers in Brazil, these findings carry significant implications. The trend observed among high-achieving students points to a gap in the current MOOC offerings. To address this, MOOC providers might consider developing more advanced or specialized courses that appeal to these students' aspirations for further challenges and learning. Such an approach could aid in retaining high-performing learners and fostering their continuous engagement with education. This strategy aligns with the overarching goal of MOOCs to provide accessible, inclusive, and diversified educational opportunities that meet the varied needs and motivations of a broad learner population.

The impact of demographic factors, such as race/color and disability on course enrollment, underscores the essential need for MOOCs to be inclusive in their design. Ensuring accessibility for students with disabilities and cultural sensitivity for students from diverse racial and ethnic backgrounds is not just a matter of ethical and educational standards but is also crucial for extending the reach and effectiveness of MOOCs in the diverse Brazilian context.

The increased engagement of lower-income students in subsequent courses highlights MOOCs' role as tools for educational equity. By providing free or affordable learning opportunities, MOOCs can help to offer educational resources to those facing financial constraints. However, this also emphasizes the responsibility of MOOC providers to align their courses with the career and educational goals of these students, potentially focusing on areas that can contribute to economic improvement.

The observation that students from rural areas are more likely to continue their education compared to those in urban centers points to a geographical disparity in educational access. MOOCs, given their online nature, have the potential to bridge this gap, offering quality education to students in remote or underserved areas. Forming strategic partnerships with local institutions and starting community outreach programs could significantly enhance MOOCs' impact in these regions.

Looking ahead, our study on Brazilian students' educational trajectories opens up several avenues for future research. A critical area for future investigation is why students with higher initial grades are less likely to enroll in subsequent courses. Conducting qualitative research, such as interviews or focus groups, could yield deeper insights into these students' motivations, ambitions, and perceived barriers to continuing education. This research could clarify whether this trend is because of satisfaction with current educational levels, a lack of challenging courses, or other personal and academic reasons.

Another important area for future research is understanding the specific needs and preferences of students from various demographic backgrounds, particularly those underrepresented in higher education. Research focusing on the educational aspirations, resource access, and effectiveness of current MOOC offerings for students of different races, income levels, and disabilities could provide valuable information. This research could guide the development of more inclusive and targeted courses and marketing strategies for MOOC providers.

The influence of geographical location on educational access and preferences, especially the contrast between students in urban and rural areas, deserves further exploration. Future studies could assess factors like internet access quality, local educational infrastructure, and socioeconomic elements that might affect engagement with online learning platforms like MOOCs.

Longitudinal studies that track students over time could offer a more comprehensive view of their educational pathways. Such studies could explore how initial MOOC engagement impacts students' long-term educational and career outcomes, particularly in Brazil's varied educational landscape. This approach would provide a fuller understanding of MOOCs' role and efficacy in shaping students' educational and professional futures.

In this study, we uncovered several key findings that challenge conventional wisdom and highlight the complexities of educational engagement in Brazil. The counterintuitive trend of high-achieving students showing a less propensity for continued education underscores the nuanced nature of academic motivation, suggesting that success in early courses does not translate into sustained educational pursuits. This revelation calls for a reevaluation of how educational success and engagement are conceptualized and fostered.

The significant impact of socio-demographic factors such as race/color, disability, and income level on enrollment decisions points to the deep-seated inequalities within the educational system. These findings emphasize the critical need for inclusive educational policies and practices that not only recognize but actively address the diverse needs and barriers faced by students from various backgrounds. The engagement of lower-income and rural students in subsequent courses highlights the potential of MOOCs as tools for democratizing education and improving socioeconomic mobility; yet, it also underscores the necessity for these platforms to align their offerings with the real-world needs and aspirations of their learners.

The limitations of our study primarily lie in its scope and the inherent challenges of interpreting large-scale educational data. While we have identified broad trends and correlations, the underlying motivations and individual experiences of students remain

unexplored. Future research should delve into qualitative investigations to uncover the personal narratives behind these statistical trends, providing a more holistic understanding of student engagement and the barriers to continued education.

Looking ahead, our findings pave the way for a multitude of research directions. Investigating the underlying reasons high-achieving students opt out of further education could reveal insights into the adequacy of current educational offerings and the psychological factors at play. Similarly, exploring the specific needs and preferences of underrepresented student groups could inform the development of more targeted and effective educational interventions. Additionally, examining the role of geographical disparities in educational access and outcomes could lead to more equitable resource distribution and policy-making.

Ultimately, this study serves as a foundation for a broader conversation about the role of MOOCs and online education in addressing educational disparities and fostering a more inclusive and equitable learning environment. As we move forward, it is imperative that we continue to challenge assumptions, embrace the complexity of student motivations and barriers, and strive for an educational system that meets the needs of all learners, regardless of their background or circumstances.

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