

How curriculum modifications shape educational pathways: Evidence from linked administrative data in Switzerland

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Abstract

The increasing heterogeneity of learning needs and preconditions in inclusive mainstream classrooms entails that not all learners are equally able to meet the regular learning objectives. In response, various integrative measures have been implemented to tailor instruction to students' individual needs. However, limited empirical evidence exists on how such measures shape students' subsequent educational pathways. The present study focuses on curriculum modifications, a measure for low-achieving students that entails individualised adaptations of learning objectives, and examines their association with educational pathways in secondary education, using Switzerland as a case study. Drawing on stigma and signalling theories, the study investigates whether receiving curriculum modifications is linked to differential educational trajectories. The analysis is based on large-scale, administratively linked test score data from four Swiss cantons and employs a propensity score matching approach to account for the multidimensional differences between students who received curriculum modifications and those who did not. Results from a series of logistic regression models indicate that students receiving curriculum modifications are more likely to enter less academically demanding educational pathways and to experience disruptive educational transitions than comparable students without curriculum modifications. These findings suggest that, despite their intention to promote inclusion, curriculum modifications may inadvertently pose

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an obstacle for students' educational pathways in secondary education.

KEYWORDS

curriculum modifications, educational pathways, inclusive education, propensity score matching, register data, secondary education, special educational needs, Switzerland, vocational education and training

Key insights

What is the main issue that the paper addresses?

The paper examines how receiving curriculum modifications, a measure that foresees individualised adaptations of learning content and objectives, affects students' educational pathways in secondary education. This paper contributes to a deeper understanding of the potential unintended consequences of curriculum modifications for students' long-term educational outcomes.

What are the main insights that the paper provides?

Drawing on large-scale, administratively linked test score data and following a propensity score matching approach, the analyses reveal that students receiving curriculum modifications are more likely to enter less academically demanding educational programmes. Despite their inclusive intent, curriculum modifications may inadvertently pose an obstacle for students' educational pathways.

INTRODUCTION

Educational transitions play a decisive role in structuring learners' life courses by shaping future educational pathways and generating enduring path dependencies. In many education systems, the transitions into lower and upper secondary education represent particularly critical junctures as they channel some students towards higher education while preparing others for labour market entry (Blossfeld et al., 2016; Triventi et al., 2020). Owing to their profound implications for later life chances, the factors and mechanisms that shape learners' educational transitions have been the subject of extensive scientific research. While there is a substantial body of evidence on the role of structural features of education systems such as tracking, and ascriptive characteristics such as socioeconomic status or migration background (e.g. Becker, 2003; Chmielewski, 2014; Jackson, 2013; Maaz et al., 2008; Terrin & Triventi, 2023), comparatively little is known about the extent to which targeted measures in the context of inclusive education are associated with students' educational pathways (Van Herwegen et al., 2026). This gap in research is noteworthy given that such measures are increasingly common in mainstream classrooms (Głodkowska & Konieczna, 2026; Schwab, 2020).

Following international efforts, including the Salamanca Declaration and the United Nations Convention on the Rights of Persons with Disabilities, inclusion in mainstream classrooms has become a key principle for providing equitable access to learning opportunities for all learners, particularly those with special educational needs and disabilities (SEND) (Ainscow, 2020; Francisco et al., 2020). Over the past two decades, the share of learners educated outside mainstream classrooms, in facilities such as special schools or special classes, has steadily decreased in most European countries (EASIE, 2024). In Switzerland, for instance, the share of students in special schools and classes has decreased from 5.3% in 2004 to 3.3% in 2024 (FSO, 2026; Lanners, 2025). In consequence, the increasing integration of learners who would previously have been placed in separate special education settings is accompanied by greater heterogeneity in learning needs and prerequisites within inclusive mainstream classrooms.

In response to the increased heterogeneity of learners in mainstream classrooms and to promote inclusive schooling, education systems have introduced a range of measures aimed at tailoring instruction to the individual needs of students (Auer et al., 2023; Harrison et al., 2013; Sahli Lozano et al., 2021). These measures are sometimes termed integrative measures, since they aim to promote students' integration in mainstream settings rather than separating them into distinct special educational needs settings. Among the most common of these integrative measures are curriculum modifications, which entail subject-specific and individualised adaptations of curricular content and modified learning objectives. Curriculum modifications typically involve reduced learning objectives and, thus, target low-achieving students who are unable to meet the regular learning objectives in the long term. Curriculum modifications can be implemented as a standalone measure—as in the case of Switzerland examined here—or within the framework of a broader system of support, such as SEN Support in the United Kingdom (e.g. Saxton et al., 2026) or *Förderschwerpunkt Lernen* in Germany (e.g. Bauer et al., 2025). However, unlike in many other education systems, curriculum modifications in Switzerland are not contingent upon formal diagnoses or an official SEND classification.

By differentiating learning content and objectives, curriculum modifications aim to enable students to participate in mainstream instruction despite not meeting the regular learning objectives. Likewise, students receiving curriculum modifications are intended to be relieved of learning expectations that lie beyond their reach (Auer et al., 2023; Hascher, 2017; Sahli Lozano et al., 2020; Schunk & DiBenedetto, 2016). Yet the implementation of targeted integrative measures for learners is not without its ambivalence. As articulated in the 'dilemma of difference' (Norwich, 2007), efforts to ensure equitable learning opportunities through individualised support may simultaneously risk reinforcing categorical distinctions by marking certain students as 'different' from their peers. In the case of curriculum modifications in Switzerland, this can occur because targeted students work towards different learning objectives than their peers and because receipt of curriculum modifications is mentioned in students' school reports. Consequently, curriculum modifications intended to foster inclusion could inadvertently contribute to processes of labelling, stigmatisation and marginalisation (e.g. Franz et al., 2023; Menze et al., 2023; Shifrer, 2013).

Against this backdrop, analysing the educational pathways in lower and upper secondary education of students receiving curriculum modifications provides a crucial lens for assessing whether these measures achieve their intended integrative effects or whether these measures may produce additional disadvantages that transcend the challenges these learners already face. To date, existing evidence on the effects of curriculum modifications (Brandenberg et al., 2026; Lustenberger et al., 2025; Sahli Lozano et al., 2024) and similar integrative measures (e.g. Bauer et al., 2025; Blanck et al., 2025; Hakkarainen et al., 2015; Menze et al., 2023; Newman et al., 2019; Van Herwegen et al., 2026) on educational pathways and general attainment remains limited, with prior studies often constrained by small

sample sizes and regionally restricted populations, limiting generalisability and analytical possibilities. To overcome these limitations, the present article investigates the educational pathways in lower and upper secondary education of learners who receive curriculum modifications using large-scale administrative data from four cantons in Northwestern Switzerland. In doing so, this study contributes to a deeper understanding of the longer-term implications of curriculum modifications and whether this measure warrants consideration in research on learners' educational pathways. More broadly, the study sheds light on potential ambivalences that are likely to arise in the provision of targeted measures for promoting the inclusion of low-achieving students and learners with SEND in mainstream classrooms.

The remainder of this article is structured as follows. The next section outlines the theoretical background and expounds upon the specifics of the Swiss context examined here. The third section provides information on the data and methods used. After presenting the results in the fourth section, concluding remarks reflect upon the implications of the findings and discuss potential limitations.

BACKGROUND

Inclusive education and curriculum modifications

Following the shift from separation to inclusive education over recent decades, a growing number of learners who would previously have attended special schools or classes are now integrated into mainstream education (Ainscow, 2020; EASIE, 2024; Francisco et al., 2020). To meet the increasingly diverse learning needs and preconditions of students and to ensure their meaningful participation in inclusive mainstream classrooms, education systems have implemented a range of targeted measures. In many countries, these measures are typically regulated and periodically reviewed within an individualised education programme (IEP) or equivalent legal documents, such as an education, health, and care (EHC) plan in the United Kingdom or a *Förderplan* in Germany (Auer et al., 2023; Sahli Lozano et al., 2021). Within a Multi-Tiered System of Supports, such measures may be situated at either Tier 2 or Tier 3 (OECD, 2026; Van Herwegen et al., 2026).

Notwithstanding variation in terminology across education systems, Harrison and co-authors (2013) proposed three types of targeted integrative measures: First, interventions that involve support through a systematic process to develop or improve targeted students' knowledge, skills or behaviours. Most notably, such assistance involves remedial instruction from special education teachers or specialised professionals, such as speech, language or psychomotor therapists. Second, accommodations consist of practices that provide a differential boost to compensate for disadvantages arising from SEND while holding targeted students to the same academic standards as their peers without SEND. For example, students with reading disabilities may complete the same assessment as their peers but with the test items being read aloud to them. Third, and in the focus of the present study, curriculum modifications involve individual adjustments to the learning content and objectives. Curriculum modifications aim to enable students to learn at their own pace and be adapted to their individual needs while remaining in a mainstream classroom setting. The measure can be understood as an institutionalised differentiation strategy that entails within-classroom ability grouping (e.g. Chmielewski, 2014; Lindner & Schwab, 2025; Smale-Jacobse et al., 2019). As such, curriculum modifications might operate in ways analogous to between-school ability grouping or tracking, with potential implications for students' educational pathways.

In the case of Switzerland, curriculum modifications are provided on a subject-specific basis and typically involve reductions in curricular learning objectives. Thus, they primarily target low-achieving students who are unable to meet the regular learning objectives in a

subject in the long term, without requiring a formal diagnosis or official SEND classification. Unlike other targeted measures used to facilitate inclusion, the target group of curriculum modifications therefore extends beyond learners with formally diagnosed SEND. Typical forms of how curriculum modifications are implemented in practice include fewer or easier tasks as well as omitting certain learning content. Apart from tailoring learning content to students' needs, the measure is intended to relieve students from learning objectives unattainable for them, an approach that is theorised to promote students' motivation and engagement and shield them from further declines in self-efficacy (Auer et al., 2023; Hascher, 2017; Sahli Lozano et al., 2020; Schunk & DiBenedetto, 2016).

Which students receive curriculum modifications and for what duration is decided by teachers together with school administrators. In the school year 2024/25, 5.2% of students in compulsory education had curriculum modifications in at least one subject. Due to cantonal differences in implementation and substantial school-level autonomy in Switzerland, prevalence differs not only between cantons but also between schools and even classrooms (FSO, 2026; Sahli Lozano et al., 2021). At present, curriculum modifications are the only low-threshold integrative measure that is systematically recorded nationwide. Receipt of curriculum modifications in a subject is mentioned in students' school reports in place of regular grades. While students with curriculum modifications are provided with a written learning report in the relevant subjects, this practice institutionalises and renders explicit the non-attainment of the regular learning objectives (see Appendix A1).

As a targeted measure employed to promote inclusive education, curriculum modifications share functional parallels with measures in the context of special educational needs support, most notably with respect to formal enactment, the institutionalisation of difference and the external visibility of the measure. An institutional particularity in the Swiss case examined here, however, is that the measure targets low-achieving students in general and is not restricted to learners with diagnosed SEND or a formalised support plan such as an IEP or EHC plan.

Prior research from Switzerland indicates that curriculum modifications are allocated in a socially selective manner, with students from disadvantaged socioeconomic backgrounds and those with a migration background being more likely to receive curriculum modifications net of cognitive abilities (Benz et al., 2026; Lustenberger et al., 2025; Sahli Lozano et al., 2023). Moreover, while teachers are found to underestimate the cognitive abilities of students with curriculum modifications (Sahli Lozano et al., 2022), emerging evidence suggests that curriculum modifications may impede academic performance (Sahli Lozano et al., 2024).

Curriculum modifications and educational pathways in secondary education

The long-term implications of students' experiences in inclusive mainstream classrooms are best understood through an examination of their educational trajectories. From a life-course perspective, secondary education constitutes a critical juncture at which educational pathways begin to diverge in ways that have lasting consequences (Schoon & Heckhausen, 2019; Triventi et al., 2020). Choices made during this stage, such as the choice between different school types at the lower secondary level or between general and vocational routes at the upper secondary level, structure students' access to credentials, institutional resources and educational opportunities, eventually shaping both individuals' acquired skills and occupational opportunities available to them (e.g. Blossfeld et al., 2016; Burger, 2021; Hillmert & Jacob, 2010). From a sociological perspective, these educational choices are often conceptualised as an anticipatory weighing of the expected costs and

benefits of different educational options with—often socially selective—perceptions of success probabilities (Breen & Goldthorpe, 1997; Erikson & Jonsson, 1996; Jackson, 2013).

In an education system like Switzerland's, which is characterised by early tracking, usually already after the completion of primary school, and a high degree of educational stratification (Buchmann et al., 2016), factors shaping students' educational pathways in secondary education have particularly profound implications for later life outcomes, including social mobility, wellbeing and health (e.g. Burger, 2021; Falcon, 2020; Hanushek et al., 2017; Korber & Oesch, 2019; SCCRE, 2026). Among European countries, Germany and Austria are the closest institutional comparators (Blossfeld et al., 2016; Van De Werfhorst, 2019). The early sorting of students into tracks or school types with distinct performance levels and academic standards gives rise to so-called 'scissor effects', whereby learning gains diverge across tracks due to differences in track-specific learning rates, differences in student composition, or institutional differences. As the performance gaps between tracks widen over time, they progressively narrow the set of viable educational options at later educational transitions. Furthermore, at the upper secondary level, the separation into general and vocational pathways creates distinct learning environments working towards different goals: preparation for tertiary education or the labour market, respectively, which further consolidates earlier attainment gaps (e.g. Maaz et al., 2008; Schindler, 2017; Terrin & Triventi, 2023; Traini et al., 2021; Van De Werfhorst, 2019).

Although curriculum modifications are relatively widespread in Switzerland, empirical evidence on their implications for students' educational pathways remains limited. Evidence from small-scale studies conducted in one Swiss canton indicates that students receiving curriculum modifications are more likely to enrol in educational programmes with basic academic requirements (Lustenberger et al., 2025) and to select into less academically demanding apprenticeships than they initially aspired to (Brandenberg et al., 2026). A broader body of research shows that students with designated SEND in mainstream classrooms tend to follow less favourable educational trajectories than their peers without SEND. Some studies indicate that students with SEND are less likely to pursue or aspire to academic upper secondary education than comparable students without SEND (e.g. Bauer et al., 2025; Chatzitheochari & Platt, 2019; Joshi & Bouck, 2017; Knight et al., 2025; Menze et al., 2023; Newman et al., 2019; Sinclair et al., 2026; Sinclair & Poteat, 2020). Moreover, students receiving special education support in inclusive classrooms show lower rates of participation in post-compulsory education, elevated dropout risks and greater difficulties during educational transitions (e.g. Blanck et al., 2025; Hakkarainen et al., 2015; Hughes et al., 2013; Kirjavainen et al., 2016; McCoy et al., 2020; Mihut et al., 2022).

Established explanatory frameworks suggest that the less favourable educational pathways of students in mainstream classrooms receiving curriculum modifications or special educational needs support do not stem from differences in academic ability alone. Instead, these students' educational pathways are shaped by institutional categorisations and the expectations they generate, with stigmatisation and signalling as plausible mechanisms underlying these processes. These concepts point to potentially adverse consequences of singling out students receiving a targeted measure as 'different' and lie at the core of the 'dilemma of difference' (Norwich, 2007).

Stigmatisation is closely linked to labelling theory, which posits that labels, such as 'receiving curriculum modifications', 'underachieving' or 'requiring special educational needs support', induce shifts in both social perception and institutional treatment (Goffman, 2009; Link & Phelan, 2001). Such labels function as symbolic markers that activate self-fulfilling prophecies, wherein the labelled individuals internalise negative stereotypes, such as perceived incompetence or insufficiency, and adjust their behaviours in alignment with these expectations. Correspondingly, students receiving curriculum modifications are expected to internalise the stigma associated with this label, develop reduced self-efficacy, and, in

turn, be disinclined to pursue academically more demanding educational programmes. Stigmatisation is sustained through social structures that validate and legitimise distinctions between what is considered 'normal' and 'abnormal', or 'able' and 'disabled' (Link & Phelan, 2001; Shifrer, 2013). For instance, research has repeatedly shown that educators hold lower performance expectations of students labelled as having SEND (e.g. Franz et al., 2023; Haft et al., 2023; Kashikar et al., 2025; Sahli Lozano et al., 2022). The extent to which the stigma associated with curriculum modifications affects educational pathways may vary across social groups. As stigma is contextual and relational, thus dependent on power, resources and social capital, some individuals are better positioned to challenge and reframe labels, eventually offsetting or mitigating their negative implications (Goffman, 2009; Link & Phelan, 2001).

Signalling theory provides a complementary perspective and emphasises the crucial role of gatekeepers during educational transitions, such as teachers, training advisors and training firms. Signalling theory posits that these actors rely on educational credentials as signals to infer productivity under imperfect information (Przepiorka, 2025; Spence, 1973). Receiving curriculum modifications, which are mentioned in students' school reports in place of regular grades (see Section '[Inclusive education and curriculum modifications](#)' and [Appendix A1](#)), not only conveys an unfavourable ability signal by indicating that regular learning objectives are not met but also increases uncertainty as the degree of deviation from the regular learning objectives remains unclear (Lustenberger et al., 2025; Menze et al., 2023). As a result, while teachers and training advisors may be disinclined to recommend students with curriculum modifications to academically more demanding programmes, training firms may be hesitant to hire them (e.g. Holtmann et al., 2021; Solga, 2002; Solga & Kohlrausch, 2013). However, the signal conveyed from curriculum modifications may not affect all students equally. Given the ambiguity of the ability signal conveyed by curriculum modifications, educators, training advisors and training firms may rely on complementary ability signals, such as presumed socioeconomic status or migration background, or resort to statistical discrimination (Arrow, 1973; Przepiorka, 2025).

The present study

Curriculum modifications are a widespread targeted measure for students who struggle to meet the regular learning objectives in inclusive mainstream classrooms. The measure is individually tailored to the specific learning needs of particularly low-achieving students and is not contingent upon formal diagnoses of official SEND classifications. Although curriculum modifications aim to facilitate inclusive education, the measure may simultaneously give rise to stigmatisation and signalling effects that can obstruct targeted students' later educational careers. The purpose of the present study is to examine whether curriculum modifications pose an opportunity or an obstacle for students' educational pathways in secondary education. This research question is examined using the case of Switzerland, and more specifically Northwestern Switzerland, a region that accounts for approximately one-sixth of the country's population.

In Northwestern Switzerland, the educational careers of learners are decisively shaped by two successive and path-dependent educational transitions within secondary education. The first occurs at the transition from primary to lower secondary education, typically at the age of twelve. At this point, students are allocated based on prior grades and teacher recommendations to school types with differing academic requirements, commonly subsumed as basic, advanced and high requirements. During this transition, students labelled as having curriculum modifications face different conditions than other low-achieving students. Teachers likely hold lower performance expectations for students with curriculum

modifications and therefore are less inclined to assign them to academically more demanding school types. Moreover, students with curriculum modifications and their parents, having internalised the stigma associated with this label, may be less disposed to contest teachers' school type recommendations (Goffman, 2009; Link & Phelan, 2001; Lustenberger et al., 2025; Shifrer, 2013). Based on these considerations, the following hypothesis is examined for the transition into lower secondary education:

Hypothesis 1. Students with curriculum modifications are more likely to enter the lower secondary school type with basic requirements (as opposed to advanced or high requirements) than comparable students without curriculum modifications.

Lower secondary education usually lasts for three years, which marks the end of compulsory education. At this point, the second crucial educational transition occurs, at which students enter upper secondary education. Here, the school type attended in lower secondary education proves particularly predictive of the educational pathways students pursue at the upper secondary level, given that school types differ in learning content and the degree to which they prepare students for general education or vocational education and training. This narrows the range of realistically attainable educational pathways, such that, for instance, students in the school type with basic requirements have limited prospects of transitioning into general education programmes (Buchmann et al., 2016; Burger, 2021; SCCRE, 2026). While learners pursuing a general education pathway receive primarily academic support, all learners in lower secondary education are provided with structured support for entry into the vocational sector through career education integrated into the curriculum, vocational guidance services and practical career exploration activities such as workplace visits. While the majority of compulsory school leavers—approximately four out of five (FSO, 2025d)—enter a programme at the upper secondary level directly, a non-negligible share of students who do not immediately find a suitable option initially enrol in non-certifying interim solutions, including bridge-year programmes, a 'motivation semester', preparatory courses or a gap year. Participation in such interim solutions has been identified as a risk factor for non-completion of upper secondary education and later unemployment (Achatz et al., 2022; Sacchi & Meyer, 2016). At the upper secondary level, students are channelled either into the historically grown vocational education and training (VET) sector (about 66%) or general education (about 34%), which grants access to universities (FSO, 2025a; SCCRE, 2026). VET is predominantly organised as a dual system that combines on-the-job training at a training firm with instruction at a vocational school. Within the VET sector, students pursue either a more typical three- to four-year apprenticeship awarding a Federal VET Diploma (EFZ) or a short-term (two-year) apprenticeship leading to a Federal VET Certificate (EBA). The latter accounts for roughly 10% of all apprenticeships (FSO, 2025b) and is specifically designed to prepare practically inclined learners with lower academic performance for labour market entry. Participation in short-term VET programmes (EBA) is associated with lower future earnings and elevated risks of unemployment (Engelage & Strebel, 2025; Fitzli et al., 2016; Kammermann et al., 2017; Meyer & Sacchi, 2020).

The educational transition to upper secondary education is likely to prove particularly challenging for students who received curriculum modifications at the end of lower secondary education. Compared to other low-achieving students, those with curriculum modifications may be less inclined to pursue academically more demanding educational programmes due to stigmatisation and associated reductions in expectations and self-efficacy (Goffman, 2009; Link & Phelan, 2001; Shifrer, 2013). Likewise, teachers and training advisors may be more inclined to counsel students labelled with curriculum modifications to less academically demanding programmes. At the same time, receiving curriculum modifications

is likely to convey an unfavourable and ambiguous ability signal to potential gatekeepers (Menze et al., 2023; Spence, 1973). Training firms, in particular, may be hesitant to hire students with curriculum modifications, or they may offer them a less academically demanding two-year VET programme (EBA) rather than a more typical three- to four-year apprenticeship (Holtmann et al., 2021; Solga, 2002; Solga & Kohlrausch, 2013). The following hypotheses are investigated for students' pathways in upper secondary education:

Hypothesis 2. Students with curriculum modifications are more likely to enter an interim solution after completing compulsory education (as opposed to direct entry into upper secondary education) than comparable students without curriculum modifications.

Hypothesis 3. Students with curriculum modifications are more likely to enter vocational education (as opposed to general education) at the upper secondary level than comparable students without curriculum modifications.

Hypothesis 4. Students with curriculum modifications are more likely to enter a short-term VET programme (as opposed to EFZ) in the vocational sector than comparable students without curriculum modifications.

DATA, MEASURES AND METHODS

Data

The educational pathways of the specific group of students receiving curriculum modifications are best examined using data covering the entire student population. This study relies on administratively linked test score data from Northwestern Switzerland, the so-called Checks (BRNWCH, 2025; König et al., 2025). The Checks comprise standardised performance assessments that are administered annually in four cantons—Aargau, Basel-Landschaft, Basel-Stadt and Solothurn—and measure students' competencies across various subjects and grade levels. For each standardised test, information is available on whether a student received curriculum modifications for the respective subject. As participation in the Checks is generally mandatory for students enrolled in public mainstream schools, the data provide near-complete coverage of student cohorts in the four cantons of Northwestern Switzerland. Beyond test scores, the Checks provide minimal information about the test takers. Data on students' educational pathways and various ascriptive characteristics were obtained through a record linkage to administrative data provided by Switzerland's Federal Statistical Office (FSO, 2025c, 2025e, 2025f) and the Central Compensation Office (CCO, 2025). The analyses consider students who participated in the Checks between 2013 and 2024, with their educational pathways observed up to 2024. Appendix A2 provides additional information on the data sources used in this study.

Three factors limit the analytical samples of this study. First, as not all students can unambiguously be identified in the administrative register data, 6.1% of all observations are excluded from the analyses. Second, due to a gradual rollout of the Checks and disparities in implementation across cantons (see Appendix A2), some standardised tests—particularly those administered before 2016—do not cover all students enrolled in public mainstream schools. To account for this, multivariate analyses include controls for the year the test was administered and the canton. Third, students with missing information on receipt of curriculum modifications or on the respective outcome measure, for instance, due to data gaps or right-censoring, are excluded from the analyses. More specifically, Hypothesis 1 is examined

using data on pupils with information on curriculum modifications at the end of primary education and on the school type attended in lower secondary education. Hypotheses 2 and 3 consider only students for whom data on curriculum modifications at the end of lower secondary education are available and whose transition into an interim solution or a programme at the upper secondary level can be observed. Finally, the analytical sample for Hypothesis 4 is restricted to students with valid information on curriculum modifications at the end of lower secondary education who subsequently entered the VET sector.

In response to missing data in the control variables, multiple imputation by chained equations (Rubin, 2018; White et al., 2011) as implemented in the R package mice (Van Buuren & Groothuis-Oudshoorn, 2011) was employed. Incomplete variables were imputed under fully conditional specification, including all study variables and creating 20 multiply-imputed datasets for each analytical sample. Estimates from complete case analyses are nearly identical to the results using multiply-imputed datasets (see Appendix D1).

Measures

A binary variable indicating whether students received curriculum modifications in one or more subjects serves as the variable of interest. The analysis of educational pathways in lower secondary education draws on the receipt of curriculum modifications prior to the educational transition, measured at the end of primary education in late fifth (from 2018) or early sixth (up to 2018) grade. For the remaining analytical samples, receipt of curriculum modifications is measured at the end of lower secondary education, prior to the transition into upper secondary education. Here, information from eighth grade—or, if unavailable, ninth grade—is used. To assess whether the implications of curriculum modifications vary across subjects, additional analyses include variables that capture only curriculum modifications in the main subjects, German and mathematics (see Appendix D3).

The present analysis considers four outcome measures, corresponding to the four hypotheses. For Hypothesis 1, students' educational pathway in lower secondary education is operationalised using a dummy variable that takes a value of one if the student enters the school type with basic requirements and zero otherwise. Hypothesis 2 is tested using a dummy variable indicating whether a student first entered an interim solution (1), such as bridge-year courses, a 'motivation semester', or a gap year, or enrolled in a programme at the upper secondary level directly upon leaving compulsory school (0). For Hypothesis 3, a dummy variable captures whether a student entered vocational (1) or general education (0) in upper secondary education. Hypothesis 4 is examined using a dummy variable that distinguishes students pursuing short-term VET (EBA) (1) from those pursuing a more typical three- to four-year apprenticeship granting a Federal VET diploma (EFZ) (0).

Both receipt of curriculum modifications and students' educational pathways are subject to selection processes. The analyses therefore account for achievement-related and socio-demographic characteristics to address well-documented confounding factors. Academic achievement plays a central role in educational decision-making and in determining whether curriculum modifications are warranted. Accordingly, the analyses consider standardised test scores in German and maths, expressed in terms of quantile ranks. Especially in a highly stratified education system like Switzerland's, earlier educational choices strongly shape the set of viable educational pathways at later stages (e.g. Buchmann et al., 2016; Burger, 2021; Sacchi & Meyer, 2016). Analyses of outcomes at the upper secondary level, therefore, control for the school type attended in lower secondary education. Furthermore, several socio-demographic characteristics are considered to capture structural inequalities in educational resources and decision-making (e.g. Becker, 2003; Blossfeld et al., 2016; Jackson, 2013). These include students' sex, first language (i.e., German vs. other language), migration status

(i.e., Swiss nationals vs. Swiss-born foreigners vs. foreign-born foreigners), parental income (in deciles), parental unemployment, household structure (i.e., single-parent household vs. other household structure), as well as characteristics of students' dwelling, namely the living area per capita and the level of urbanisation of students' place of residence. Additional information on study variables and descriptive statistics is provided in [Appendices A3](#) and [B1](#), respectively.

Analytical strategy

Because curriculum modifications target low-achieving students who are unable to meet the regular learning objectives, random assignment necessary for analysing treatment effects is precluded. Low-achieving students constitute a specific subgroup for which prior research identifies particular risk factors that are unequally distributed across population groups (e.g. Astle et al., 2019; Holtmann et al., 2023; Sahli Lozano et al., 2023). Propensity score matching (e.g. Abadie & Imbens, 2016; Ho et al., 2007) was employed as a preprocessing strategy to account for the multidimensional differences between students who received curriculum modifications and those who did not, thereby enabling meaningful comparisons between these groups and mitigating selection bias. In substantive terms, propensity score matching allows students with curriculum modifications to be contrasted with students without curriculum modifications who not only exhibit a comparably low academic achievement profile, but who are also similar with regard to various ascriptive characteristics associated with the likelihood of receiving curriculum modifications (see Section '[Prevalence of curriculum modifications](#)' and [Appendix B2](#)). In a first step, the probability of receiving curriculum modifications (i.e., the propensity score) was estimated for each student using logistic regression analyses controlling for potential confounders (see [Appendix B2](#)). Then, students with and without curriculum modifications who were similar on their propensity score were matched using a nearest-neighbour matching algorithm at a 1:1 ratio, without replacement and without imposing a calliper, to create samples that are balanced on all covariates. Propensity score matching was performed for each analytical sample separately and within each multiply-imputed dataset (Ho et al., 2011; Pishgar et al., 2021). Assessments of covariate balance confirm that the matching procedure effectively created balanced samples (see Section '[Prevalence of curriculum modifications](#)' and [Appendix B3](#)).

Matching samples were then analysed using logistic regression models. In addition to bivariate specifications, regression models include multiple additional covariates to account for any residual imbalance. In a matching samples design, these variables serve primarily as controls to increase precision of the estimate of curriculum modifications; their point estimates may be biased by the matching constraints and, thus, do not carry a meaningful interpretation (Ho et al., 2007; Westreich & Greenland, 2013). Regression analyses were conducted on each of the 20 multiply-imputed datasets, and the estimates are combined following Rubin's rules (Rubin, 2018). For ease of interpretation, results are presented in terms of average marginal effects (e.g. Mize et al., 2019).

To assess the robustness of the results and their sensitivity to methodological choices, several supplementary analyses were performed: In addition to complete case analyses ([Appendix D1](#)), a series of models using alternative approaches to pre-processing than the outlined propensity score matching were estimated. These include propensity score matching with a calliper of 0.2, generalised full matching, entropy balancing and full sample analyses without any preprocessing by matching or weighting ([Appendix D2](#)). Additionally, models were estimated for which curriculum modifications were restricted to specific subjects ([Appendix D3](#)) as well as subgroup analyses ([Appendix D4](#)). A replication package including all code files is provided online at <https://osf.io/wy6pt>.

RESULTS

Prevalence of curriculum modifications

Curriculum modifications are fairly common in the cantons of Northwestern Switzerland before both the transitions to lower and upper secondary education. Around 7.8% of students have curriculum modifications in at least one subject by the end of primary school; this share declines to approximately 4.9% by the end of lower secondary education. Within lower secondary education, the prevalence of curriculum modifications varies considerably by school type, with the highest share observed in the school type with basic requirements (11.7%) and the lowest in the school type with high requirements (1.1%). However, the allocation of curriculum modifications is marked by selection effects along several dimensions. Evidently, students with poor academic performance in the core subjects German and mathematics are most frequently affected by curriculum modifications. At the end of primary school, for example, 16.9% of students in the lowest tertile of test scores in mathematics receive curriculum modifications, compared to 3.5% of students in the middle tertile and 1.7% in the highest tertile. Moreover, pronounced disparities in the allocation of curriculum modifications emerge based on ascriptive characteristics. Students from lower income deciles, students with a first language other than German, students born in Switzerland, and those living in modest residential circumstances are consistently overrepresented across all analytical samples. Detailed sample descriptions are provided in [Appendix B1](#), and regression models on receipt of curriculum modifications are provided in [Appendix B2](#).

The non-random allocation of curriculum modifications necessitates a pre-processing procedure to mitigate the influence of confounding variables. As illustrated in [Figure 1](#), propensity score matching in a 1:1 ratio effectively neutralises the observed disparities and achieves covariate balance between the students receiving curriculum modifications and their matched controls. Following propensity score matching, all included covariates exhibit (standardised) mean differences below 0.1 across all analytical samples. The resulting matching samples comprise 6823 (Basic Requirements), 3810 (Interim Solution), 3440 (Vocational Education) and 3191 (Short-Term VET) matched pairs, all of which fall into the region of common support. [Appendix B3](#) provides additional information on balance assessment before and after matching.

Curriculum modifications and later educational pathways

Based on descriptive evidence from the full analytical samples, the educational pathways of students with curriculum modifications diverge markedly from those of their counterparts without curriculum modifications. Students who received curriculum modifications at the end of primary education enter the lower secondary school type with basic requirements at considerably higher rates (74.3%) than students without curriculum modifications (21.0%). In view of the decline in the share of students with curriculum modifications from primary to lower secondary education (see Section '[Prevalence of curriculum modifications](#)'), it is conceivable that placement in the school type with basic requirements may substitute curriculum modifications for some students, as this school type is more capable of catering to the learning needs of low-achieving students. Similarly, students with curriculum modifications at the end of lower secondary education exhibit markedly higher incidences of interim solutions (30.6% vs. 11.9%) and enter the vocational sector more often than peers without curriculum modifications (92.8% vs. 68.3%). Within the vocational sector, 39.5% of students with curriculum modifications start training in a short-term VET programme compared to 6.8% of those without curriculum modifications. Within the entire student

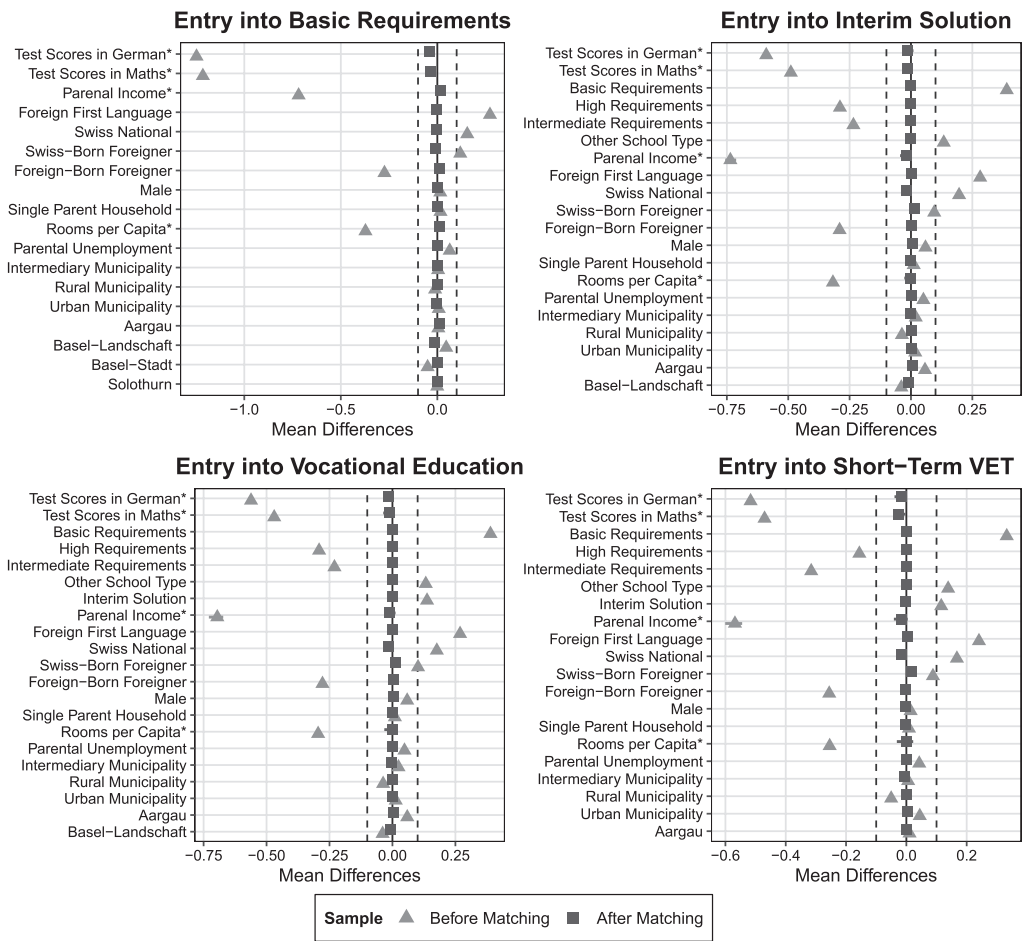


FIGURE 1 Covariate balance before and after matching. Comparison of mean differences between students with and without curriculum modifications before and after propensity score matching. Mean differences of continuous predictors (*) were standardised. Dashed vertical lines at mean differences of -0.1 and 0.1 indicate the conventional threshold for acceptable balance. Data: Checks 2013–2024 (BRNWCH, 2025), FSO (2025a, 2025b, 2025c) and CCO (2025), own calculations.

population, students with curriculum modifications follow distinct educational pathways, though this may simply reflect their relatively low academic performance. The question arises whether these disparities hold if only students with comparable characteristics are juxtaposed.

Table 1 presents the results from logistic regression models using matching samples in terms of average marginal effects with 95% confidence intervals in brackets. To illustrate the main results, Figure 2 depicts adjusted predictions of the educational pathways of students with curriculum modifications and their matched controls.

Overall, regression results using matching samples provide empirical support for all four hypotheses. In line with Hypothesis 1, students with curriculum modifications enter the lower secondary school type with basic requirements at substantially higher rates than their matched controls (AME=0.148, CI=[0.133, 0.163], $p<0.001$). Compared with otherwise similar students, those with curriculum modifications are more likely to delay entry into post-compulsory education, as indicated by the higher entry rates into interim solutions (AME=0.075, CI=[0.053, 0.096], $p<0.001$). This finding is consistent with Hypothesis 2.

TABLE 1 Results from logistic regression models.

	Basic requirements		Interim solution		Vocational education		Short-term VET	
	Bivariate	Multivariate	Bivariate	Multivariate	Bivariate	Multivariate	Bivariate	Multivariate
Curriculum modifications	0.151*** [0.134, 0.168]	0.148*** [0.133, 0.163]	0.073*** [0.050, 0.095]	0.075*** [0.053, 0.096]	0.042*** [0.025, 0.059]	0.037*** [0.024, 0.051]	0.171*** [0.145, 0.197]	0.164*** [0.139, 0.189]
Observations	13,646	13,646	7620	7620	6880	6880	6382	6382
AIC	16,998.946	13,578.594	8832.288	8036.197	4236.782	2509.903	7681.381	6709.775
BIC	17,013.988	13,781.666	8846.166	8230.476	4250.455	2701.322	7694.903	6899.090
RMSE	0.465	0.401	0.442	0.417	0.290	0.228	0.454	0.421
R ²	0.026	0.269	0.007	0.117	0.005	0.388	0.034	0.171
M	20	20	20	20	20	20	20	20

Note: Pooled results from logistic regression models using samples from 1:1 propensity score matching in terms of average marginal effects with 95% confidence intervals in brackets. Significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Data: Checks 2013–2024 (BRNWCH, 2025), FSO (2025a, 2025b, 2025c) and CCO (2025), own calculations.

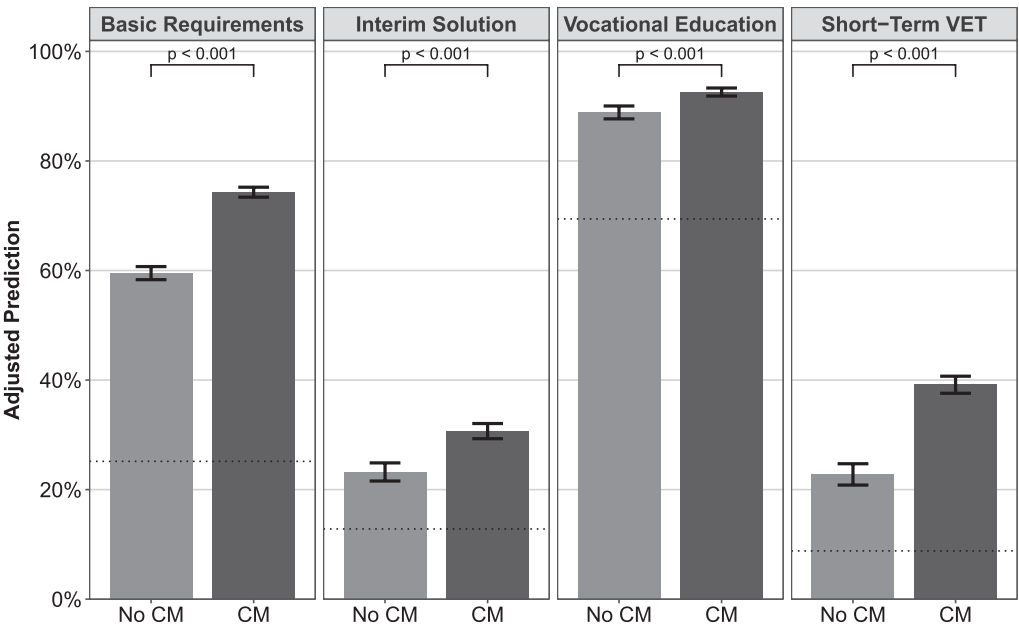


FIGURE 2 Adjusted predictions of students' educational pathways. Adjusted predictions in terms of percentages with 95% confidence intervals by curriculum modification (CM) and outcome measure. The dotted horizontal lines indicate the share of students enrolled in the entire student population. All group differences are statistically significant at $p < 0.001$. Data: Checks 2013–2024 (BRNWCH, 2025), FSO (2025a, 2025b, 2025c) and CCO (2025), own calculations.

Regarding Hypothesis 3, both students with curriculum modifications and their matched peers predominantly enter the vocational sector. Still, regression results show that students who had curriculum modifications are 3.7 percentage points (CI = [2.4 pp., 5.1 pp.], $p < 0.001$) more likely to enter vocational education as opposed to general education at the upper secondary level. Finally, consistent with Hypothesis 4, a remarkable gap between students with and without curriculum modifications is identified concerning the propensity to pursue short-term VET programmes (EBA) as opposed to the more typical three- to four-year VET programmes (EFZ). While 39.1% (CI = [37.6%, 40.7%]) of students with curriculum modifications are expected to enrol in short-term VET, the corresponding percentage of matched controls lies at 22.8% (CI = [20.8%, 24.7%]), which resembles a highly statistically significant difference ($p < 0.001$).

Robustness and sensitivity checks

To assess the robustness and sensitivity of the results, several robustness and sensitivity checks were conducted, including alternative approaches to propensity score matching, restrictions to the treatment variable and subgroup analyses. Figure 3 summarises the results of these checks by presenting point estimates in terms of average marginal effects across all alternative specifications. Further details on these analyses are provided in Appendix D.

Overall, the results prove substantially robust across different model specifications with respect to the direction, magnitude and statistical significance of the estimated effects. As illustrated by the dotted lines in Figure 3, the point estimates from the robustness and sensitivity checks largely fall within or directly adjacent to the 95% confidence intervals of the estimates from the baseline models reported in Table 1. There are, however, some notable

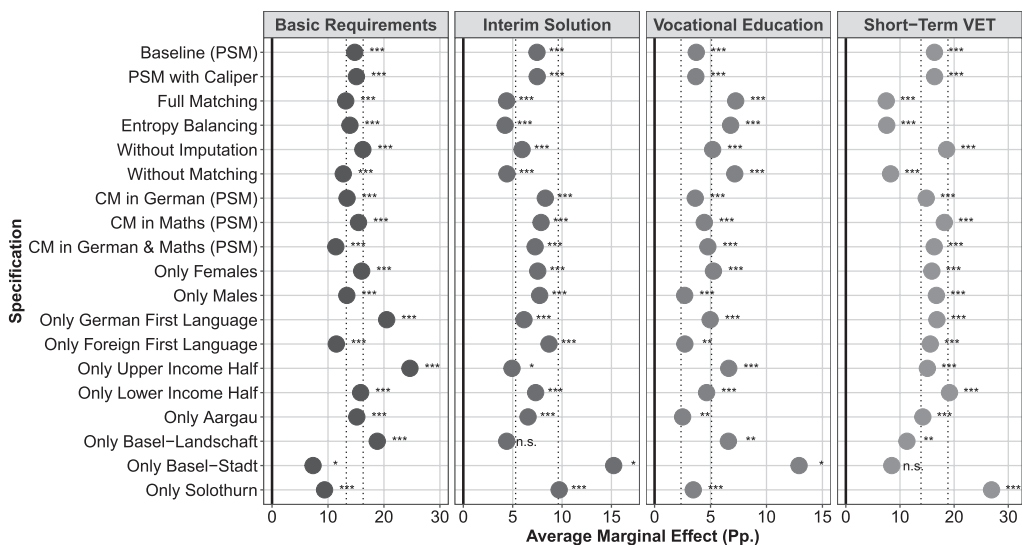


FIGURE 3 Point estimates of sensitivity and subgroup analyses. Point estimates of curriculum modifications (CM) by outcome measure from logistic multivariate regression models in terms of average marginal effects. The dotted vertical lines indicate the 95% confidence intervals of the estimates from the baseline models using propensity score matching (PSM) reported in Table 1. Full regression tables and further information on specifications are provided in Appendix D. Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, n.s. = not significant. Data: Checks 2013–2024 (BRNWCH, 2025), FSO (2025a, 2025b, 2025c) and CCO (2025), own calculations.

exceptions to this. For the outcomes following the completion of lower secondary education, estimates using samples based on full matching and entropy balancing are largely aligned with one another but diverge from the estimates from the baseline models. This pattern may reflect bias arising from random pruning when using propensity score matching (King & Nielsen, 2019). Subgroup analyses based on parental income and students' first language produce somewhat different point estimates. Future research is encouraged to investigate whether this is a matter of effect heterogeneity or whether these gaps rather stem from differential selection processes into curriculum modifications. In a similar vein, estimates from subgroup analyses by canton vary considerably, which is likely due to smaller sample sizes, especially in Basel-Stadt and Basel-Landschaft and the associated difficulties in finding matching pairs (see Appendix D1).

DISCUSSION

Efforts towards inclusive education entail a growing diversity of students' learning needs and preconditions in mainstream classrooms, which are addressed by various integrative measures. To date, evidence on the implications of such measures for students' educational pathways remains scarce. The present study contributes to the literature by examining whether curriculum modifications function as an opportunity or an obstacle to students' educational pathways. It does so by drawing on comprehensive administratively linked data from Northwestern Switzerland and employing a propensity score matching approach. The findings suggest that curriculum modifications, despite their inclusive intent, are associated with academically less demanding and more discontinuous pathways in secondary education.

Curriculum modifications operate within the 'dilemma of difference' (Norwich, 2007), insofar as the intended relief for low-achieving students through adapted learning content and reduced learning objectives could coincide with being marked as 'other'. In the case of

curriculum modifications, this tension is particularly apparent given that receipt of the measure is mentioned in students' school reports in place of regular grades. With mechanisms of stigmatisation and signalling (Goffman, 2009; Link & Phelan, 2001; Przepiorka, 2025; Spence, 1973) as possible explanatory approaches, receiving curriculum modifications is expected to inadvertently pose an obstacle to students' educational pathways. This argument is empirically examined, guided by four hypotheses that cover the two central educational transitions in secondary education in Northwestern Switzerland.

Consistent with Hypothesis 1, students receiving curriculum modifications at the end of primary education enter the basic requirements school type in lower secondary education at substantially higher rates than comparable students without curriculum modifications. This finding could reflect lowered academic expectations arising from the label attached to curriculum modifications, affecting both teacher recommendations and learners' educational aspirations (Franz et al., 2023; Shifrer, 2013). The transition into upper secondary education is of a different nature, as it additionally involves gatekeepers such as training advisors and training firms who may perceive curriculum modifications mentioned in students' school reports as an ability signal (Lustenberger et al., 2025; Menze et al., 2023; Solga, 2002). Taken together, the results are in line with Hypotheses 2–4, suggesting that receipt of curriculum modifications at the end of lower secondary education is associated with constrained educational pathways at the upper secondary level. The gaps between students with curriculum modifications and their matched controls are particularly significant regarding entry into non-certifying interim solutions and short-term VET programmes. The findings across both transitions point to a consistent—and substantially statistically robust—pattern: Receiving curriculum modifications is associated with less academically demanding and, in part, more discontinuous educational pathways. The results, thus, support the findings from prior studies using limited samples (Brandenberg et al., 2026; Lustenberger et al., 2025) and add to the existing evidence on the educational pathways of students receiving special educational needs support (e.g. Bauer et al., 2025; Chatzitheochari & Platt, 2019; McCoy et al., 2020; Menze et al., 2023).

While curriculum modifications enable low-achieving students to participate in mainstream education, this measure appears to have unintended adverse implications for students' educational careers—and, by extension, their later educational and occupational prospects (Hanushek et al., 2017; Korber & Oesch, 2019). Given their uneven allocation across different student populations (Benz et al., 2026; Lustenberger et al., 2025; Sahli Lozano et al., 2023), curriculum modifications may, thus, contribute to a reproduction of existing educational inequalities. This raises the question of whether curriculum modifications should remain so widely used in educational practice. However, such a conclusion warrants careful qualification on three grounds. First, notwithstanding potential labelling and signalling effects, students with curriculum modifications are still able to access post-compulsory education in the vast majority of cases. Although they tend to disproportionately enter programmes with lower academic requirements, which poses a well-documented risk to long-term social mobility and restricts access to advanced credentials, these educational pathways offer by no means less viable career pathways, nor do they fundamentally impede social mobility (e.g. Burger, 2021; Engelage & Strebel, 2025; Falcon, 2020; Fitzli et al., 2016). Second, it remains unclear how these students would fare without curriculum modifications. Curriculum modifications are meant to promote inclusive education and thus function, to a certain extent, as a substitute for separative forms of special education, from which there has been a shift away over the past two decades in Switzerland. Without this measure, some students might struggle to participate in mainstream education and instead be placed in special education settings, which also has been shown to negatively affect educational careers (e.g. Blanck et al., 2025; Joshi & Bouck, 2017; McCoy et al., 2020; Sinclair et al., 2026). Therefore, the results of this study do not inform about the extent to which curriculum modifications affect

structural inequalities in the education system overall but rather demonstrate that measures that aim to support the educational integration of learners do not necessarily entail a reduction of such structural inequalities. Third, the findings of this study represent a system-wide pattern among all students receiving curriculum modifications in Northwestern Switzerland, without, however, giving closer consideration to the fact that these students may face vastly different challenges in their educational pathways depending on their specific needs. Existing research indicates not only that the low-achieving students targeted by the measure constitute a highly heterogeneous group (e.g. Astle et al., 2019; Holtmann et al., 2023), but also that the patterns of educational pathways may vary depending on the type of support needs (e.g. Cheatham & Randolph, 2022; McCoy et al., 2020).

Nonetheless, it would merit consideration by policymakers to rethink how curriculum modifications in mainstream classrooms are implemented. The findings of this study, however, do not call the use of curriculum modifications into question as such. Inclusive education does not require identical learning objectives for all students but explicitly calls for adapting learning content to students' educational needs. With differentiation, a well-established approach exists that is geared precisely towards this aim and offers concrete guidance on the pedagogical practices needed to achieve it (e.g. Lindner & Schwab, 2025; Smale-Jacobse et al., 2019). The challenge rather lies in how curriculum modifications are reported, communicated and interpreted, especially during educational transitions. For instance, grade-based school reports could be complemented with competence-based descriptions of students' abilities, such as portfolios that document students' learning progress across domains and over time. Although curriculum modifications entail deviations from regular curricular learning objectives, the measure does not prevent students from acquiring the competencies needed to perform tasks in vocational training and the labour market. Furthermore, closer collaboration between schools and training firms could contribute to communicating the competences of students with curriculum modifications more clearly. It is equally important that teachers contribute to mitigating potential stigmatisation associated with curriculum modifications by approaching deviations from academic norms less strongly from a deficit perspective and promoting targeted students' academic self-efficacy. Given the evidence of selectivity in the allocation of curriculum modifications along ascriptive characteristics beyond differences in academic achievement, allocation practices should likewise become subject to critical scrutiny, which could be achieved, for example, through more standardised criteria for curriculum modifications and systematic monitoring.

Although the findings cohere with the theoretical expectations and previous research, some limitations sound a note of caution. While the comprehensive, administratively linked data allow for population-level inferences across almost entire cohorts, they do not capture how curriculum modifications are implemented in practice. Differences in the quality, timing and intensity of implementation of curriculum modifications, as well as other forms of support for targeted students, thus remain obscured. Especially since schools have considerable discretion in the implementation of curriculum modifications, an explicit account of the school context would be advisable for future research. Likewise, it cannot be empirically captured whether and to what extent the observed associations actually reflect stigmatisation and signalling mechanisms, nor which of these mechanisms prevails, or whether entirely different mechanisms are in play. Furthermore, unobserved confounders, such as specific forms of SEND or students' educational preferences, may threaten the validity of the findings. While the linked administrative data used allow for a comprehensive examination of a specific and, in the Swiss context, understudied subpopulation of students receiving curriculum modifications, additional research approaches are needed to better contextualise the empirical associations within a theoretical framework. It also remains unclear whether the assumption of strong ignorability holds, implying that treatment assignment is effectively random conditional on observed

characteristics and independent of the outcome measure (Abadie & Imbens, 2016; Ho et al., 2007), especially since educational performance is considered a predictor for assignment to curriculum modifications during matching. Low academic performance is certainly a prerequisite for curriculum modifications, but it may also result from receiving curriculum modifications, since students with curriculum modifications pursue reduced learning objectives (Sahli Lozano et al., 2024). The data structure precludes resolution of these issues, thus limiting causal claims.

Notwithstanding these limitations, the present study highlights the ambivalent role of curriculum modifications as a means to address heterogeneity in students' learning needs and preconditions. While curriculum modifications support integration into mainstream education, they may simultaneously constrain students' subsequent educational pathways. Similar ambivalences might arise in various aspects of the targeted provision of support for learners with SEND, and specifically in lower-threshold forms of support that do not presuppose legal documents such as an EHC plan or IEP. This stresses the importance of not only providing support to learners who struggle academically in inclusive classrooms, but also carefully considering how these measures are designed, implemented and interpreted during key educational transitions. Addressing these tensions may be an important step towards ensuring that inclusive education does not inadvertently reproduce the very inequalities it seeks to overcome. Scholars and policymakers alike are, thus, encouraged to consider students' learning needs and targeted measures like curriculum modifications as factors important to their educational trajectories. Future research could contribute to the field by broadening the empirical evidence on possible adverse implications of integrative measures across different educational contexts or types of measures, by investigating effect heterogeneity in greater depth, by taking into account the concrete implementation of curriculum modifications in practice, and by incorporating the perspectives of learners, educators and potential gatekeepers.

AI STATEMENT

The authors used Quillbot and Claude to proofread and correct the language and grammar of selected passages in the submitted manuscript. None of these tools were used to verify the content accuracy of the checked text fragments. The authors assume full responsibility for the accuracy and integrity of the scientific content presented in this publication.

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CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

DATA AVAILABILITY STATEMENT

The Scientific Use Files of the Checks are provided by the Bildungsraum Nordwestschweiz and are available at SWISSUbase (<https://doi.org/10.48573/mdbd-x247>). Linked register data were provided by the Federal Statistical Office (FSO) and the Central Compensation Office (CCO) under contract number 250301. A replication package including [Supporting Information](#) and code files is available at <https://osf.io/wy6pt>.

ETHICS STATEMENT

Ethical approval for this research project was obtained from the Bern University of Teacher Education Ethics Committee.

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