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Non-formal education and life satisfaction

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SOEP papers
on Multidisciplinary Panel Data Research

Non-Formal Education and Life Satisfaction

Li Kathrin Kaja Rupieper and Stephan Thomsen

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Non-Formal Education and Life Satisfaction

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Abstract

Lifelong learning is increasingly recognized as important for individual well-being, but causal evidence on this relationship remains scarce. This paper evaluates the effects of non-formal adult education on life satisfaction by exploiting the substantial expansion of courses at East German *Volkshochschulen* (VHS) following reunification. Combining individual well-being data from SOEP with administrative VHS data, we use quasi-random variation in individuals' exposure to courses to identify intention-to-treat effects. Estimation results denote small but significant and robust effects of VHS education on life satisfaction. Calculations of average treatment-on-the-treated effects suggest considerably stronger impacts among actual course participants. We furthermore reveal effect heterogeneity across demographic groups. In contrast to formal education, which is commonly found to raise aspirations, we find no corresponding effect of VHS education. Overall, our findings suggest that non-formal courses and training provide an easily accessible, low-cost means of adaptation in times of transformation.

Keywords: Volkshochschule, adult education, transformation, SOEP,
Germany, subjective well-being, natural experiment

JEL Classification: H52, I26, I31, N34, P29

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1 Introduction

Education is widely regarded as a key determinant of individual well-being. Until now, research has focused extensively on the benefits of formal learning such as schooling (Oreopoulos and Salvanes, 2011; Kristoffersen et al., 2025), leaving the welfare effects of non-formal, adult learning largely unexplored. This omission is striking given the growing policy emphasis on lifelong learning, demonstrated for example by the inclusion of the promotion of lifelong learning opportunities for all to the Sustainable Development Goals (UN, 2015).¹ Particularly in the rapidly transforming and ageing labor markets of industrialized countries, adults are presumed to increasingly rely on continuing education to maintain skills, social participation, and life satisfaction (see, for example, OECD, 2025). However, whether non-formal adult education generates measurable well-being gains remains an open question with direct implications for public spending (see, for example, ILO, 2023).

This paper addresses this research gap by evaluating the contribution of non-formal adult education to life satisfaction.² To this aim, we exploit the substantial and decentralized expansion of adult education courses in East Germany after reunification as a natural experiment. These courses were run at *Volkshochschulen* (VHS), which had been subject to state control in the German Democratic Republic (GDR). Following German reunification, the East German VHS regained autonomy in designing their educational programs and consequently expanded their educational activities. Between 1991 and 2001, the number of implemented courses rose from 1.3 to 3.6 per thousand inhabitants, representing a nearly threefold increase (authors’ calculations). During this expansion, organizational aspects led to quasi-random variation in the local availability of VHS courses, meaning that individual exposure to VHS education was as good as random.

VHS are among the most important institutions for adult education in Germany (Wittenbrink and Frick, 2018). Between 1991 and 2001, East German VHS recorded almost five million enrollments in their courses (authors’ calculations). Due to state constitutions, VHS exist in nearly every German county (Ruhose et al., 2023). Their primary aim is to enable personal development and societal participation (Süssmuth and Eisfeld, 2018). VHS offer non-formal education, meaning that courses do not lead to a formal degree or certificate, but still take place in an organized and structured manner.³ VHS courses cover a wide array of topics and most courses take place once a week over several months. Thanks to substantial subsidies, participation fees are comparatively low. Participants with low incomes can additionally request financial support to cover course

¹SDG 4 calls to “*ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*” (UN, 2015). The corresponding Millennium Development Goal, however, referred to primary education only.

²We use the terms life satisfaction, subjective well-being, and happiness interchangeably.

³This last aspect also distinguishes non-formal learning from informal learning, which lacks organization and structure.

fees, as VHS aim to be accessible to everyone.

During the East German transformation, adult education and training played a major role in helping adults to adjust to new circumstances. The East German transformation was so comprehensive that it upended not only the political and economic system, but also workplace stability and social networks. Non-formal courses may have helped East Germans to overcome the associated challenges while simultaneously supporting them in benefiting from the accompanying opportunities.⁴ For many adults, evening courses and similar formats may be more accessible than formal education, given the substantial time commitment required to obtain a degree. In addition, adult education centers like VHS can quickly adapt their course programs to societal needs, as their rapid up-scaling of German language courses in times of pronounced immigration has shown (Thomsen and Weilage, 2021). In this way, non-formal education may support adults in substantial ways with respect to achieving the lives they value, ultimately fostering subjective well-being.

The most widely accepted theory of subjective well-being predicts that life satisfaction remains mostly stable over the life course, with short-term fluctuations only (see, for example, Easterlin, 2003). Yet, empirical studies have repeatedly documented lasting changes in life satisfaction (see, for example, Headey and Muffels, 2018). Such changes can be understood when considering life satisfaction as the outcome of a utility, or happiness, function (Easterlin, 2003). This function depends on a set of arguments capturing monetary and non-monetary living conditions and aggregates satisfaction over various life domains. Within each domain, individuals evaluate their attained living conditions relative to their aspired ones. Consequently, both changes in aspirations and living conditions can affect life satisfaction. Since education may raise both, theory alone does not provide a clear prediction as to whether education ultimately increases life satisfaction.

To the best of our knowledge, existing studies on the effects of adult education on well-being are all observational, documenting small positive but sometimes statistically insignificant correlations (Tuijnman, 1990; Feinstein and Hammond, 2004; Hammond and Feinstein, 2006; Field, 2009; Jenkins and Wiggins, 2015; Boeren, 2021; Granderath et al., 2021; Boyadjieva and Ilieva-Trichkova, 2024). These correlations do not necessarily imply that participation in adult education causally improves life satisfaction. Alternatively, it may also be that happier people are more likely to participate in adult education, or that a third, omitted factor drives both life satisfaction and participation in adult education. In both cases, patterns of self-selection into adult education would be the underlying reason for the positive correlations. The results of several studies attest to the importance of self-selection into adult education: Both Boeren (2021) and Boyadjieva and Ilieva-Trichkova (2024) find a weaker correlation when controlling for determinants

⁴Rupieper and Thomsen (2025), for example, provide evidence from the same natural experiment that VHS education can reduce unemployment, with effects depending on course content and local labor market demand.

of life satisfaction and participation in adult education. And Granderath et al. (2021) find significant correlations only on the between-person level, but not in within-person comparisons. While Feinstein and Hammond (2004, p.199) acknowledge self-selection into education to be part of the “*positive cycles of development and progression*” constituting learning, it also prevents us from understanding the true causal effect of adult education on life satisfaction. Against this backdrop, Field (2009, p.187) states that “*we need a more differentiated view of the impact of learning*”.

This paper contributes to a better understanding of the causal relation between adult education and life satisfaction. We combine administrative data on the educational activities of VHS with the SOEP, a comprehensive panel dataset including information on individuals’ life satisfaction. Because the SOEP does not track participation in VHS courses, we can only observe the local availability of VHS courses to individuals. Nevertheless, the quasi-random variation in individual exposure to courses allows us to identify causal intention-to-treat (ITT) effects. To this end, we estimate two-way fixed effects models that control for year-specific shocks and unobserved heterogeneity across individuals.

Our results indicate a small but significant positive effect of VHS courses on life satisfaction. Relying on the conventional life satisfaction scale ranging from 0 to 10 (see, for example, OECD, 2013), the most conservative specification finds an increase of 0.03 points, statistically significant at the 10 % level. Compared to the baseline level of life satisfaction in 1990, this corresponds to a 0.46 % increase. Accounting for the probability of participation further allows us to calculate the average treatment-on-the-treated (ATT) effect, which suggests that actual course participants experienced an increase in life satisfaction of 1.05 points, corresponding to a 16 % increase relative to the baseline. Results are robust to including various measures of local economic activity, variations in the clustering of standard errors, and further alterations of the estimation model.

Given that life satisfaction results from the comparison of aspirations and actual attainments, we furthermore evaluate whether VHS adult education systematically affects aspirations. We find no evidence of shifts in life goals, professional expectations, or attitudes towards the future. Formal education, by contrast, is commonly found to raise aspirations, thereby attenuating its well-being gains (see, for example, Clark et al., 2015). This finding suggests that the mechanisms shaping aspirations and expectations differ substantially across different types of education.

Focusing on average causal effects, however, can mask substantial heterogeneity across population subgroups. Understanding which groups benefit relatively less from VHS education allows to design courses valuable to previously underserved groups. We therefore estimate whether the well-being gains of VHS education differ across population subgroups. The results indicate that highly educated individuals and those with high incomes benefit more from VHS courses than the rest of the population, whereas church members and older individuals experience significantly smaller well-being gains. These results are largely

consistent with documented participation patterns in adult education (see, for example, BMBF, 2003, 2015). Many imbalances typical of the German education system (see, for example, BMBF, 2022) appear to be less pronounced in the VHS context, which supports the notion that VHS mostly achieve their goal of being accessible to everyone.

This paper proceeds as follows. In Section 2, we explain the theoretical perspective on how adult education affects life satisfaction. Section 3 describes the quasi-random expansion of VHS courses in East Germany. Section 4 entails a description of our data. The empirical strategy is explained in Section 5. This section also contains plausibility tests of the identifying assumption. In Section 6, we present the results of our main analysis, investigations of the underlying mechanism and heterogeneous effects across population subgroups, as well as several robustness checks. We conclude in Section 7.

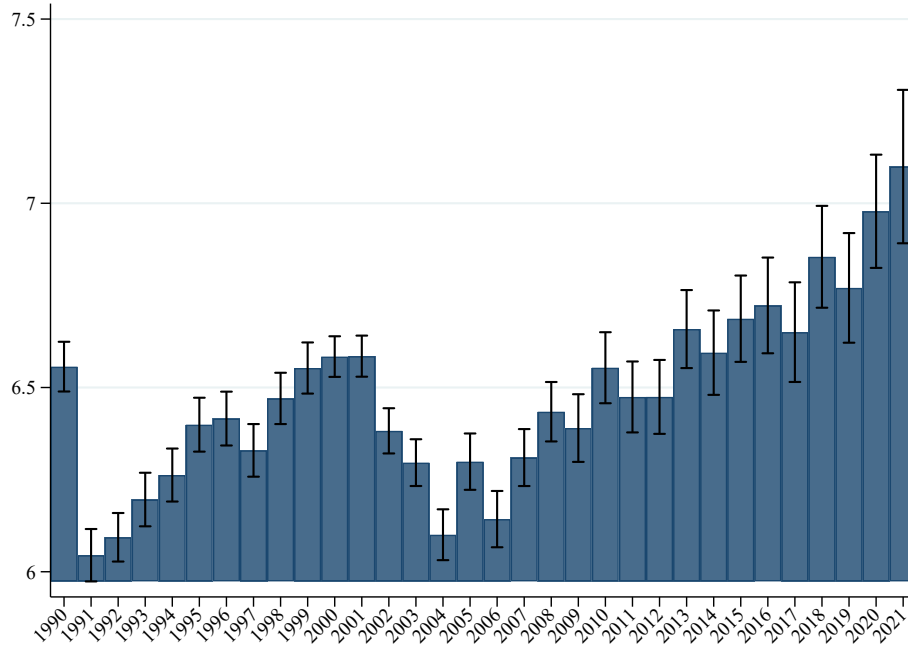
2 Theoretical Perspective

The most widely accepted theory explaining life satisfaction is the so-called setpoint or adaptation level theory (Brickmann and Campbell, 1971; Lykken and Tellegen, 1996; Easterlin, 2003; Diener et al., 2009). According to this theory, satisfaction is mostly stable over the life course. Life events may lead to short-term fluctuations, but individuals are expected to adapt to changing living conditions. In consequence, their life satisfaction converges back to its original set point. This stability in life satisfaction is said to originate from genetic factors, parental influence, and stable personality traits, such as neuroticism and extraversion. However, such a view on life satisfaction implies that both individuals' efforts to become happier as well as societal actions and policies to increase well-being are futile, as persistent changes in well-being are considered impossible to achieve.

Contrary to this theoretical prediction, East Germans' life satisfaction changed markedly. Over the three decades following reunification, it rose substantially, as Figure 1 shows. In 1990, average life satisfaction stood at 6.6 points on a scale from zero to ten.⁵ In the following year, East Germans rated their life satisfaction substantially lower, with an average of only 6 points. By then, many businesses had closed, unemployment - which was virtually non-existent in the GDR - surged, and people faced substantial uncertainty and dislocation as the socialist system gave way to the market economy. Initial hopes for sudden economic prosperity were dashed. In the following years, as living circumstances improved and income increased, the life satisfaction of East Germans rose (also see Frijters et al., 2004a,b; Easterlin and Plagnol, 2008). At the turn of the millennium, mean life satisfaction returned to its 1990 level, but subsequently declined from 2001 to 2004. Internationally, this period was marked by the altered global security environment following

⁵It should be noted that in 1990, the East German SOEP interviews took place from May to July, before the formal reunification of East and West Germany in October. Usually, SOEP interviews occur earlier in the year, mostly from January to April. See Figure A.2 in the appendix.

Figure 1: Average Life Satisfaction in East Germany



Data Source: SOEP v38.1.

Notes: Authors' calculations, showing mean life satisfaction and its 95 % confidence interval. The sample is limited to respondents of full age, living in East Germany at the time of the interview and having lived there in 1989.

the 9/11 attacks and subsequent wars (also see Priem and Schupp, 2014). In Germany, the persistently high unemployment hinted at structural labor market problems, leading to the implementation of the so-called Hartz reforms between 2003 and 2006. After 2006, life satisfaction continued to rise, with some smaller, temporary reductions. The 2009 global financial crisis, for example, was accompanied by only a short-lived decline in life satisfaction. By 2010, life satisfaction reached previous peak levels again. In 2021, East Germans' life satisfaction reached its highest level overall, with a mean value of 7.1 points.

The question of whether life satisfaction can change persistently has also been the topic of numerous empirical studies. While these studies document a strong intrapersonal stability in life satisfaction over time, they also find long-term changes in life satisfaction for a substantial subset of respondents (Fujita and Diener, 2005; Headey, 2006; Diener et al., 2009; Headey et al., 2010; Luhmann et al., 2012; Headey and Muffels, 2018). Headey and Muffels (2018) find that changes in personal values, life priorities and behavioral choices affect life satisfaction. As such changes happen only rarely and new attitudes are likely to persist, they may lead to mid- and long-term changes in life satisfaction. In contrast to the set point theory, which predicts that life events lead to short-term fluctuations only, empirical studies have found that some life events are so major that they persistently impact life satisfaction. These major life events encompass unemployment (Lucas et al., 2004; Clark et al., 2008; Hahn et al., 2015), the onset of a lasting disability

(Lucas, 2007), the death of a child (Wortman and Silver, 1989), bereavement in general and childbirth (Luhmann et al., 2012).

How, then, can we explain life satisfaction, given that persistent change occurs? In the quantitative social sciences, subjective well-being is typically modeled as the outcome of a utility or happiness function (see, for example, Easterlin, 2003):

$$SWB = \sum_{j=1}^J w_j (X_j - \tilde{X}_j). \quad (1)$$

This function views overall life satisfaction as the sum of satisfaction across J life domains. As indicated by the varying weights w_j , these domains of life may differ in their relative importance for overall life satisfaction. Within each domain of life, individuals evaluate their satisfaction by comparing their attainments X_j to their aspirations or expectations $\tilde{X}_j$. These vectors capture both pecuniary and non-pecuniary living conditions. Accordingly, life satisfaction can shift when the importance of specific domains of life, attained living conditions, or aspirations and expectations change.

In this line of reasoning, one might expect education to enhance life satisfaction, as it typically improves earnings, labor market opportunities, and other aspects of life. However, the empirical evidence does not coincide with this view. Studies using exogenous variation in educational attainment caused by compulsory schooling reforms yield inconsistent results: while Oreopoulos (2007) and Jiang et al. (2020) find a positive effect of additional schooling on well-being, other studies do not find clear evidence supporting such a well-being effect (Banks and Mazzonna, 2012; Dursun and Cesur, 2016; Avendano et al., 2020). Clark and Jung (2023) even report a negative effect of additional compulsory education on life satisfaction.

The relation between education and life satisfaction becomes clearer when individuals' aspirations are taken into account, as education often raises both aspirations and opportunities for achievement. Consequently, life satisfaction should increase when education improves living conditions to a greater extent than it raises aspirations. Put differently, a raise in life satisfaction is expected when the elasticity of real world opportunities with respect to education exceeds that of aspirations (Ferrante, 2009). Supporting this view, Clark et al. (2015) show that half of the happiness effect of formal education is canceled out by heightened aspirations.⁶

⁶Psychological research highlights two key mechanisms for changes in aspirations: adaptation and social comparison (Easterlin, 2003; Ferrante, 2009; Clark et al., 2015). When life circumstances shift, people often adjust their aspirations accordingly and adapt to the new situation. The extent of adaptation varies across life domains. For instance, complete adaptation is typical for the economic domain, where material aspirations often increase commensurately with income (Easterlin, 2003). In the family or health domain, however, adaptation is less complete and aspirations often remain stable despite changing living conditions. Because preferences are often viewed as fixed and exogenously given in Economics, there are only few economic theories that explicitly address preference change. Changes in reference points or habit formation are the ones most closely related to adaptation. Social comparison, in turn, means that well-being depends

From a theoretical perspective, the total effect of adult education on life satisfaction remains unclear. Adult education may enhance individuals' attainments by improving various aspects of life, especially during periods of transformation, such as in East Germany after reunification, and when conducted in the emancipatory tradition of VHS (see below). In addition, adult education may shift individuals' aspirations and goals. While formal education commonly raises aspirations, this does not necessarily apply to non-formal learning. Especially in times of collective hardship, social comparisons facilitated by the interactions at VHS courses may attenuate aspirations. Whether and how VHS education affected life satisfaction during the East German transformation thus remains an empirical question.

3 The Expansion of VHS Courses in East Germany

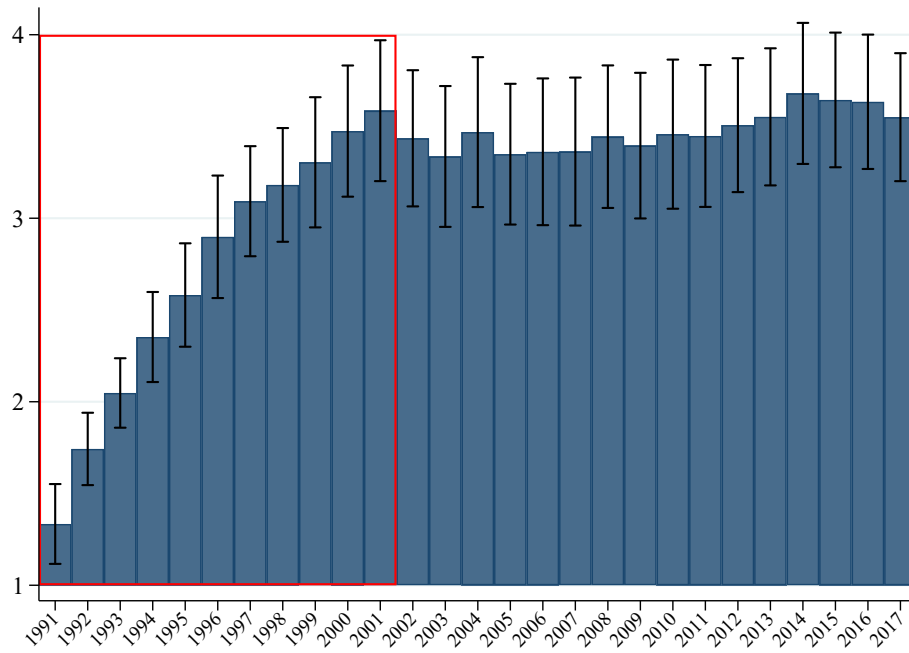
The availability of VHS courses in East Germany increased strongly in the years following the reunification. As Figure 2 shows, the average county had 1.3 VHS courses per thousand inhabitants in 1991. By 2001, this number had almost tripled to 3.6 courses per thousand inhabitants. The expansion of courses then came to a halt: After 2001, the mean course density fluctuated around a relatively stable value of 3.6 courses. To exploit the quasi-randomness in the local availability of VHS education, we focus the analysis on the expansion period in VHS courses between 1991 and 2001.

While VHS had also existed in the GDR, their programs were predefined by the government and mainly provided an alternative route to secondary school diplomas (Siebert, 2001; Gieseke, 1994). After reunification, the majority of the East German adult education organizations ceased operations (Siebert, 2001). VHS were among the few organizations in this realm that persisted, but faced challenges such as finding a new organizational form and funding. As early as 1990, East German schools joined the umbrella organization *Deutscher Volkshochschul-Verband* (DVV), which had previously encompassed only West German VHS. In the same year, state-level associations were founded in the new East German federal states. In order to support the East German VHS in their restructuring, partnerships between East and West German VHS (as well as their respective state-level associations) were build.

With the reunification, the topical focus of VHS courses changed profoundly. In contrast to their previous role as night-schools for adults in the GDR, basic education courses, which may lead to school-leaving degrees, constituted only a small minority of courses (see Figure 3). As early as 1991, courses on the topics of work & occupation and language courses made up the majority of VHS courses. Language courses were offered

not only on one's own outcomes but also on those of others (see, for example, Ferrer-i-Carbonell, 2005). It should be noted that this mechanism can change aspirations in both directions. Economists describe this mechanism as interdependent preferences (Easterlin, 2003), which are particularly relevant for positional goods, such as education.

Figure 2: Mean Number of VHS Courses per Thousand Inhabitants

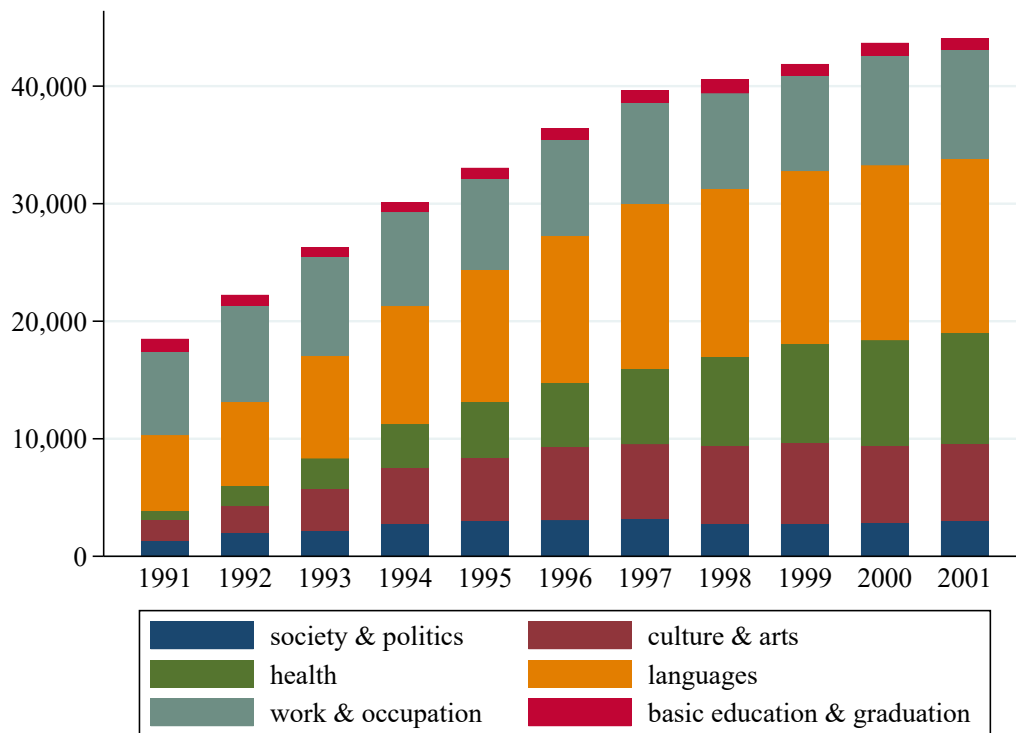


Data Sources: VHS, BBSR.

Notes: This figure shows the mean number of VHS courses per thousand inhabitants across East German counties. The red box highlights the expansion period. Confidence intervals are given at the 95 % level. Standard errors are clustered at the county level. County boundaries as of 2019.

in a wide range of languages. Work & occupation courses encompassed for example job application trainings, civil law for entrepreneurs, accounting or typewriting courses. These two subject areas remained important until the end of the observed period. Between 1991 and 2001, the largest increase in course numbers is found for courses on health topics. These courses deal for example with nutrition, back exercises or yoga. But also the number of courses on the topics of culture & arts (e.g. on literature, fine arts, drawing) and society & politics (e.g. on Europe, regional history, and political systems) increased in this time period.

Figure 3: Topics of VHS Courses



Data Sources: VHS, BBSR.

Notes: Sum of VHS courses by topic area and year. The sample is restricted to VHS located in East Germany.

In the GDR, centralized planning and control were central for the education system, and education and ideological training were strongly intertwined. Also VHS were subject to state control in relevant areas, such as curriculum design, the selection of teaching staff or course participants (Hoggan-Kloubert et al., 2025). In addition to conveying educational contents, VHS courses had to aim at political-ideological impact as well. Employees of the *Stasi*, the state security service, regularly sat in on classes to control their ideological alignment (Siebert, 2001, p. 290ff). However, invoking “*adults’ intelligent resistance to learning*”, Siebert (2001, p. 292, translated by the authors) doubts the success of this attempted indoctrination. With the reunification, the state control over VHS ceased and East German VHS regained their autonomy. To this day, they independently select

their teaching staff and decide which courses to offer. As educational activities expanded into new subject areas and many school managers and principals were pensioned off after the reunification (Siebert, 2001, p.299), a generational shift occurred among staff, thereby accelerating the change process. There is no longer any systematic ideological indoctrination of participants. Instead, VHS cover a plurality of viewpoints. Lastly, participation in courses is entirely voluntary.

Since the reunification, the programs of East German VHS are decided upon solely by the local school manager. The design and organization of the course program lies entirely in their hands (Schrader, 2011, p. 348 ff). To do so, school managers need to balance conflicting demands and requirements, including financial constraints, the availability of teaching staff and suitable rooms. Managers have considerable leeway in doing so. While they try to factor in future interest in courses, participants or teachers are not systematically included in the design of courses in any way. Well-established courses are often copied into the program of the next semester, but innovations such as the introduction of new courses depend strongly on the person of the school manager. Personal likes and dislikes, as well as coincidences, matter greatly for the design and organization of a VHS program. From a potential participant’s perspective, the availability of VHS courses thus appears effectively random and exogenously determined.

4 Data

We build a novel panel dataset by combining comprehensive information about individuals from the German SOEP with administrative data on the educational activities of VHS. The resulting individual-level panel has over 36,000 person-year observations and covers East German SOEP respondents from 1990 to 2002. Table A.1 in the appendix presents the corresponding summary statistics: Between 1991 and 2002, East Germans were exposed to 2.61 VHS courses on average, with substantial variation. On a scale from 0 (completely dissatisfied) to 10 (completely satisfied), life satisfaction reached an average of 6.37 points.

Data on VHS’ educational activities stem from the VHS statistic, which is provided by the German Institute for Adult Education (DIE, 2018). This panel dataset gathers information about each school’s number of courses, events, class hours, and enrollment numbers. The first survey for the VHS statistic took place in 1962 in West Germany. While the VHS statistic is digitally available for the years from 1987 onwards, East German VHS started to report in 1991 only (DIE, 2014).⁷ We aggregate the VHS data at the county level. However, the reorganization of East German county borders makes it necessary to transfer all VHS data to a harmonized set of county borders. We use a population-based

⁷A few schools started to report later, which leads to missing VHS course information for 2 out of the 76 East German counties in 1991. The share of non-reporting schools declined quickly in the following years and by 1993, the VHS statistic provides information on all East German counties. For school mergers and divisions, we follow the procedure used by Ruhose et al. (2023).

crosswalk provided by the Federal Office for Building and Regional Planning (BBSR, 2024) for doing so. This procedure enables the combination of the VHS statistic with other datasets, such as the SOEP.

Information about individuals' life satisfaction, aspirations, expectations, and socio-demographic characteristics comes from the SOEP (Goebel et al., 2023). The SOEP provides comprehensive individual-level data from 1984 onwards for West Germany. First surveys in East Germany were conducted in 1990 (Wagner et al., 2008), four months before the reunification and one month before the Economic, Social and Monetary Union (Goebel et al., 2019). To ensure the representativeness of our results for the East German population, we use individual weighting factors (also see Knies and Spieß, 2007; Frick and Goebel, 2008). As the course expansion took place only in East Germany, we limit the SOEP sample to East German respondents. This means that we only consider persons that used to live in East Germany in 1989 and that lived in East Germany at the time of the interview. In addition, as we are interested in the effects of adult education, we restrict the dataset to respondents aged 18 years and older.

SOEP respondents are asked on a yearly basis to rate their current life satisfaction on a scale from 0 (completely dissatisfied) to 10 (completely satisfied). This measure of subjective well-being reflects a cognitive evaluation of a person's overall quality of life based on their own criteria (Diener and Diener, 1995; Shin and Johnson, 1978).⁸ The survey also captures individuals' aspirations and expectations. While aspirations inform us about individuals' goals, expectations additionally reflect the perceived probability of achieving them. We select corresponding SOEP variables based on their fit to our hypotheses. In addition, items must be included in at least two survey waves during the course expansion period to enable the estimation of within-person comparisons. The first set of variables captures individuals' life goals and describes what respondents aspire to achieve in their lives. They rate, for example, how important it is to them to own a house, live in a happy marriage, and be socially and politically active. In addition, respondents are asked how confident they feel about the future, reflecting expectations in a general and broad manner. A third group of variables captures expectations about various job-related events to occur in the next two years, such as losing a job or retiring.

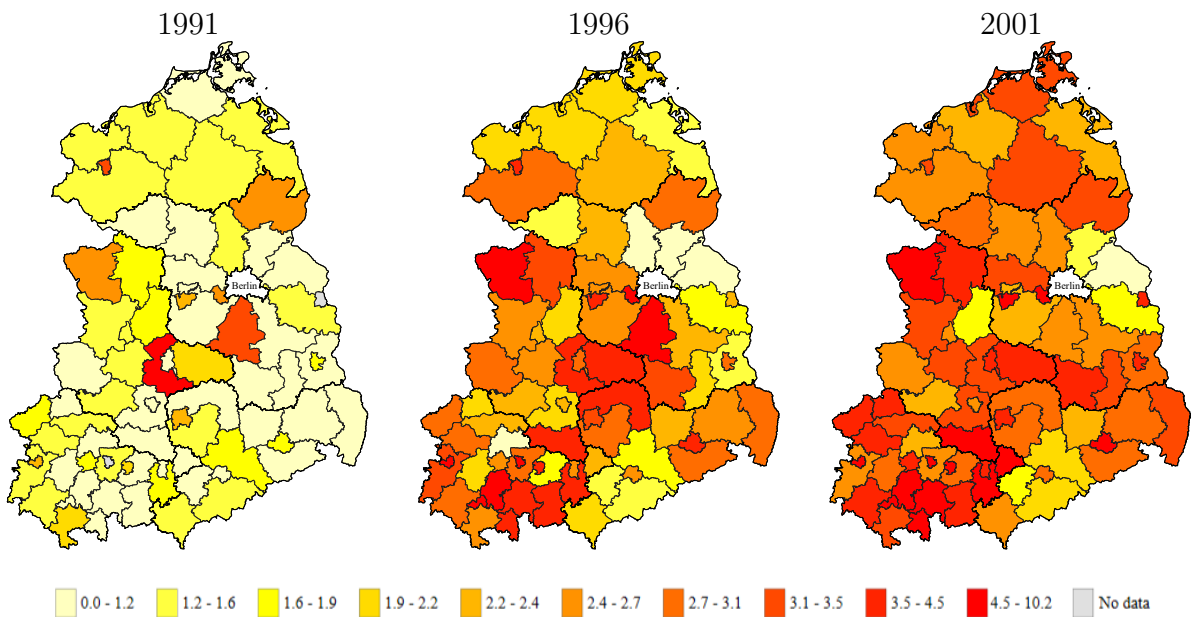
Since the SOEP does not track whether individuals participate in VHS courses, we rely on their exposure to courses instead. Exposure is measured as the number of VHS courses per thousand inhabitants based on the county of residence. We scale courses by population to ensure the comparability of the exposure measure across differently populous counties. Annual population data for German counties come from the Federal Office for Building and Regional Planning (BBSR, 2024). Alternatively, the number of course enrollments per thousand inhabitants could be used to measure individuals' exposure. Given the high

⁸This cognitive evaluation of well-being differs from affective or emotional well-being dimensions, such as joy or happiness (Diener et al., 2018).

correlation of 0.94 between course counts and enrollments in our sample, we expect only minor differences to arise from this alternative measurement. Since course counts are more informative for policy and organizational purposes, we therefore focus on their effects.

For additional robustness tests, we furthermore use information about the number of unemployed persons per county. The Federal Employment Agency provides such data digitally for East German counties for all years since 1996 (Bundesagentur für Arbeit, 2005). In a previous paper, we digitized county-level unemployment figures for East Germany covering 1992-1995 (see Rupieper and Thomsen, 2025, for details). We combine both data sources to control for local labor market trends. Another robustness test controls for local economic developments based on daytime satellite data (Lehnert et al., 2023b), which informs about the type of surface that any geographic area entails. As some surface types are more closely related to economic activities than others, daytime satellite data can predict local GDP (Lehnert et al., 2023a). To minimize the noise that may result from that prediction, we rely on the logarithmized surface shares.

Figure 4: Spatial Variation in the Availability of VHS Courses



Data Sources: VHS, BBSR, © GeoBasis-DE/BKG 2024

Notes: Maps showing the number of VHS courses per thousand inhabitants for all East German counties, boundaries as of late 2019. For two counties, there are no VHS reports for 1991. The categorization of courses is based on the deciles of the distribution of VHS courses per thousand inhabitants in the expansion period. Because the VHS statistic does not distinguish between East and West Berlin VHS, we exclude Berlin from our analysis.

5 Empirical Strategy

5.1 Identification Strategy

Our identification strategy exploits the quasi-random variation in the availability of VHS courses in East Germany after reunification. The maps presented in Figure 4 illustrate the expansion of VHS courses over time. While availability was low in most counties in 1991, it increased to a multiple thereof over the following decade. But even within any given year, the maps reveal considerable variation in course availability across East German counties. To evaluate the effect of VHS courses on life satisfaction, we estimate the following two-way fixed effects model using OLS:

$$y_{ict} = \alpha + \beta \times \text{courses}_{c,t-1} + \gamma X_{ict} + \delta_i + \delta_t + \epsilon_{ict}, \quad (2)$$

where y_{ict} is the outcome of interest of individual i living in county c in year t . α denotes a constant. The regressor of interest, $\text{courses}_{c,t-1}$, is the number of VHS courses per thousand inhabitants in the previous year. Since courses take place throughout the year, using the lagged exposure to courses ensures that only terminated courses may affect the outcome. δ_i stands for person fixed effects, which control for individual heterogeneity. This includes the time-invariant part of the propensity to participate in adult education as well as the time-invariant, personality-determined part in life satisfaction (see, for example, Boyce, 2010). δ_t denotes year fixed effects, which account for year-specific shocks. Following the design component argument from Abadie et al. (2023), standard errors are clustered at the county level.

The vector X_{ict} contains several individual-level controls, encompassing educational level, age, marriage status, logarithmized net household income, and an indicator for unemployment. These characteristics are shown to correlate with both life satisfaction and participation in adult education (see, for example, Clark, 2018; BMBF, 2015). Controlling for them increases the precision of the estimation results. Additionally, the vector X_{ict} includes the number of interviews that a respondent has already participated in. As respondents gain more experience in answering questions regarding their life satisfaction, their ratings tend to be lower (Van Landeghem, 2014). Controlling for the number of interviews solves this problem of panel conditioning.

Since we cannot directly track individuals' course participation, we rely on their exposure to courses instead. Consequently, the parameter of interest, β , captures the intention-to-treat (ITT) effect. This parameter averages the effect of VHS adult education among all individuals who may have participated in courses. This comes with the advantages of eliminating the problem of self-selection into courses and capturing the total effect of adult education, including potential spill-over effects on non-participants. As non-participants dilute the estimation of the treatment effect, the ITT estimates should be

regarded as lower-bound-estimates of the causal effect of adult education on life satisfaction. For individuals who participate in VHS courses only due to their increased availability, often referred to as *compliers*, we expect a larger treatment effect.

To get a better understanding of how VHS courses affected participants’ well-being, one can arrive at the average treatment effect on the treated (ATT) by dividing the ITT by the treatment probability (see similar applications for example in Bettinger et al., 2012; Havnes and Mogstad, 2011). As we cannot observe participation probability in VHS courses directly, we proxy it by dividing the county-level number of course enrollments by county population instead. Following this procedure, average probability of participating in a VHS course is 3.23 % (see Table A.1), so that $ATT = ITT/0.0323$. This ATT effect represents the change in life satisfaction due to participating in a VHS course among course participants. As the proxy measure of participation probability negates that individuals may participate in more than one course, these estimates should be considered as an upper-bound of the ATT effect.

5.2 Plausibility of the Identifying Assumption

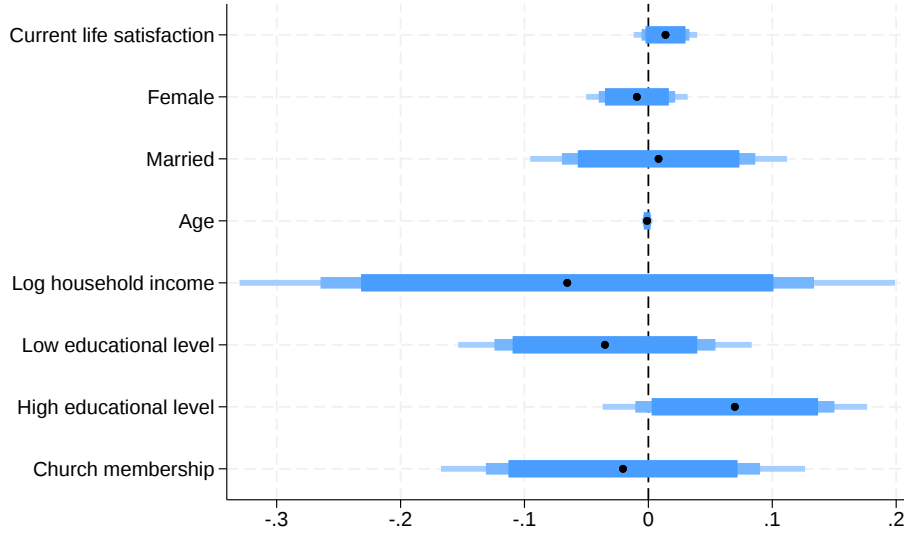
The identification strategy relies on the assumption that individuals’ exposure to VHS courses is independent of their own well-being. As the number of realized courses results from the interplay of local supply and demand, endogeneity in either may undermine the identifying assumption. However, since we only have data on the realized number of courses, we refrain from discussing hypothetical associations which we cannot test. Instead, we follow an approach suggested by de Chaisemartin and D’Haultfœuille (2023, p.265ff) for natural experiments with quasi-random treatment doses described below.

To substantiate the validity of the identifying assumption, we test for correlations between VHS courses and the “pre-treatment” outcome as well as covariates. To this aim, we refer to the county-level course numbers in 1991, the first year we have data on East German VHS’ educational activities for, and individuals’ well-being and socio-demographic characteristics as of 1990. Correlations between the treatment and pre-treatment characteristics would hint towards endogeneity problems. Correlations between the treatment and pre-treatment outcomes could also hint towards reversed causality. To inspect correlations with pre-treatment outcomes and characteristics, we estimate the following regression model using OLS:

$$courses_{c,1991} = \alpha + \beta \times SWB_{ic,1990} + \gamma X_{ic,1990} + \epsilon_{ict}, \quad (3)$$

where $courses_{c,1991}$ denotes the number of VHS courses per thousand inhabitants in 1991 in county c . $SWB_{ic,1990}$ denotes the subjective well-being of individual i in 1990 living in county c . The vector $X_{ic,1990}$ refers to the socio-demographic characteristics of gender, marriage status, age, the logarithmized monthly net household income, educational level,

Figure 5: Correlation of Individuals' Pre-Treatment Characteristics with 1991's Course Availability



Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: Confidence intervals are shown at the 90, 95 and 99 % level. Paler bars refer to higher significance levels. Standard errors are clustered at county level. A Wald test of joint significance fails to reject the null hypothesis that the listed variables have no joint influence on the later exposure to VHS courses (test statistic: 0.909, p-value: 0.514).

and church membership. Standard errors are clustered at the county level.

Figure 5 shows the estimation results. Table A.2 in the appendix presents the estimation results in detail. First and foremost, life satisfaction and later exposure to VHS courses are not significantly correlated. This alleviates potential concerns about reversed causality. In addition, we find no significant correlations between later course exposure and most of the further pre-treatment characteristics. But there is one statistically significant correlation: Individuals holding a tertiary degree as of the summer of 1990 were exposed to 0.07 more VHS courses per thousand inhabitants in 1991.⁹ This correlation is significant at the 10 % level only, meaning that one would expect one out of ten tests to falsely reject the null hypothesis. Thus, the observed correlation could be induced by multiple hypothesis testing.

We additionally conduct a test of joint significance to understand whether the pre-treatment outcomes and characteristics jointly explain later course exposure. The results

⁹This finding may indicate two different things: Firstly, educated people are more prone to participating in adult education (BMBF, 2003, 2015; OECD, 2021). Residential segregation by education may lead to regional differences in the demand of adult education. However, we prefer the second, alternative explanation: Educated individuals may have raised the local supply of courses, as VHS lecturers are typically highly qualified. 73 % of teachers in continuing education have an academic degree (Wirtschafts- und Sozialforschung, 2005, p.48). Finding suitable teaching staff may have been a critical bottleneck for school managers, especially in the early years of the expansion, when new topical areas were built up. The association between tertiary education and later course exposure is indeed weaker and insignificant for all later years (see Figure A.1 in the appendix).

fail to reject the null hypothesis, indicating that, even when considered jointly, pre-treatment outcomes and characteristics are not significantly correlated with individuals' subsequent exposure to VHS courses (test statistic: 0.909, p-value: 0.514). Taken together, these results mitigate potential endogeneity concerns and support the plausibility of the identifying assumption.

6 Empirical Findings

6.1 Life Satisfaction

Table 1 reports the regression estimates for life satisfaction. Column 1 includes only a constant and the course exposure measure, finding that being exposed to an additional VHS course per thousand inhabitants increases life satisfaction in the following year by 0.1 points (significant at the 1 % level). However, omitted variables may distort this result. Column 2 adds the number of prior interviews to control for panel conditioning. As expected, the estimated marginal effect of VHS courses on life satisfaction increases slightly, reaching 0.12 points (significant at the 1 % level). Column 3 additionally includes socio-demographic characteristics, that is marriage status, household income, educational level, and an indicator for whether a person is registered as unemployed, which reduces the estimated effect to 0.07 points (significant at the 1 % level). Column 4 introduces year fixed effects to absorb shocks common to all East Germans in a given year. This reduces the estimated effect to 0.05 points, which is now significant at the 5 % level only. Our preferred specification is the most conservative one displayed in Column 5, which additionally includes person fixed effects to account for time-invariant heterogeneity between individuals. The results of this within-person comparison imply an increase in life satisfaction of 0.03 points (significant at the 10 % level).

Overall, we find small positive effects of exposure to VHS courses on life satisfaction, suggesting that VHS education increases life satisfaction. The results are robust across all specifications. The effect estimated in the preferred specification appears small relative to the mean and standard deviation of life satisfaction. However, the estimates report ITT effects only and must be scaled by the participation probability to arrive at the ATT. In the most conservative specification reported in Column 5, this linear transformation indicates substantial gains of 1.05 points ($= ITT/0.0323$) in life satisfaction among actual course participants. Given a baseline value of life satisfaction of 6.57 points, this corresponds to a 16 % increase. In terms of standard deviations, the effect corresponds to a well-being gain of 58 % of a standard deviation. Since our measure of participation probability neglects that individuals may participate in more than one course, the ATT calculation may serve as an upper-bound estimate of the true effect of participation.

Table 1: The Effect of VHS Courses on Life Satisfaction

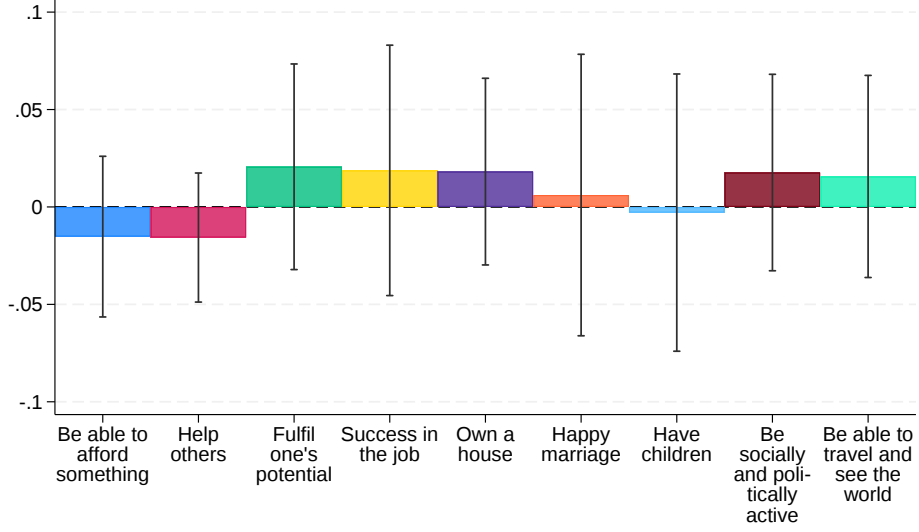
	Life satisfaction				
	(1)	(2)	(3)	(4)	(5)
Course exposure	0.10*** (0.03)	0.12*** (0.03)	0.07*** (0.02)	0.05** (0.03)	0.03* (0.02)
Number of survey waves		-0.02** (0.01)	-0.03*** (0.01)	-0.04*** (0.01)	-0.12 (0.10)
Married			-0.17*** (0.05)	-0.15*** (0.05)	0.02 (0.07)
Log household income			0.64*** (0.05)	0.61*** (0.05)	0.50*** (0.04)
Low educational level			0.03 (0.06)	0.03 (0.06)	-0.28** (0.11)
High educational level			-0.03 (0.06)	-0.02 (0.06)	0.07 (0.11)
Registered as unemployed			-0.87*** (0.07)	-0.87*** (0.07)	-0.54*** (0.05)
ATT effect	3.22	3.62	2.30	1.64	1.05
Year fixed effects				✓	✓
Person fixed effects					✓
N	36,030	36,030	36,030	36,030	36,030
Adjusted R^2	0.00	0.00	0.07	0.07	0.50

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: This table reports the estimated ITT effect of an additional VHS course per thousand inhabitants on East Germans' life satisfaction, as surveyed between 1992 and 2002. Scaling with the probability of course participation allows to approximate the ATT effect. The baseline value for life satisfaction in 1990 is 6.57 on a scale from 0 to 10. Individuals were exposed to an average of 2.46 VHS courses per thousand inhabitants. Standard errors are given in parentheses and clustered at the county level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 6: The Effects of Course Exposure on the Importance of Various Life Goals



Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: This figure displays the estimated ITT effects. Individuals rated the importance of a specific life goal on a scale quite important (1) to very important (4). Confidence intervals are shown at the 90 % level. Standard errors are clustered at county level. Life goals were surveyed in the years 1992 and 1995.

6.2 Aspirations and Expectations

Life satisfaction depends on the interplay between individuals' actual attainments and their aspirations and expectations. To better understand the channels through which non-formal adult education affects life satisfaction, we therefore examine whether exposure to VHS courses influences individuals' aspirations and expectations. Table A.1 in the appendix presents the summary statistics for these outcomes.

One way to measure aspirations is to ask survey respondents about their life goals. To ease the comparison of life goals across various persons, the SOEP takes a pre-defined list of potential life goals and asks respondents to rate their importance on a scale from one to four. This list covers goals from different domains such as owning a house, success in the job, having children, and being able to travel and see the world. We recode these items such that higher values refer to greater importance. Then, we estimate the marginal effect of being exposed to an additional VHS course per thousand inhabitants on the importance of various life goals. Figure 6 shows the results: Exposure to VHS courses did not affect the importance given to any of the included life goals in a statistically significant manner (see Table A.3 in the appendix for the detailed regression results). It should be noted, though, that the small number of observations may have reduced the power of the tests on statistical significance, as the importance of life goals was only surveyed twice during the observation period.

To minimize the chance that these null-results are a result of low observation numbers,

we evaluate the effect of VHS courses on further aspiration-related outcomes captured in more survey waves. One of these additional measures is respondents' confidence in the future, which captures their expectations about the future in a broad and general manner. Respondents rated their level of agreement with the statement “*When I think about the future, I am actually quite optimistic*” on a scale from one to four. Again, we recode answers such that higher values refer to greater confidence. As Table 2 shows, the estimates vary in size, direction, and statistical significance across specifications. In our preferred specification, however, we find no significant effect of VHS courses on individuals' confidence about the future. This null-result aligns with the previous findings on life goals.

Table 2: The Effect of Course Exposure on Confidence in the Future

	When I think about the future, I am actually quite optimistic.				
	(1)	(2)	(3)	(4)	(5)
Course exposure	−0.01 (0.01)	0.04** (0.01)	0.02 (0.01)	0.03* (0.01)	−0.03 (0.02)
Number of interviews		✓	✓	✓	✓
Socio-demographic characteristics			✓	✓	✓
Year fixed effects				✓	✓
Person fixed effects					✓
N	15,166	15,166	15,166	15,166	15,166
Adjusted R^2	0.00	0.02	0.04	0.06	0.40

Data Sources: VHS statistic, SOEP v38.1, BBSR.

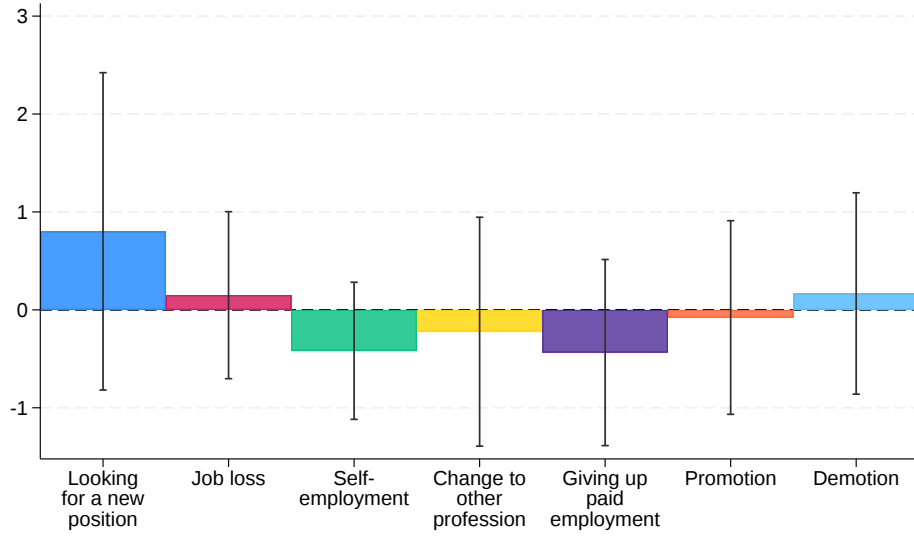
Notes: This table reports the estimated ITT effect of VHS course exposure on East Germans' confidence about the future, as surveyed in 1992, 1993, and from 1995 to 1997. Confidence about the future is rated on a scale from one to four. The baseline value (as of 1990) corresponds to 2.75 points. On average, individuals were exposed to 2.46 courses per thousand inhabitants. Standard errors are clustered at the county level and are given in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Lastly, we also analyze whether VHS courses shifted job-related expectations. The SOEP surveys how individuals rate the probability of various job-related events to take place in the next two years. This includes desirable and undesirable events, such as promotions and demotions. Events also differ in the degree that individuals can influence them - while the decision to look for a new position is entirely up to oneself, losing a job is commonly against one's will. The expectations of becoming self-employed, changing to another profession, and giving up paid employment altogether are also captured. Figure 7 shows that exposure to an additional VHS course per thousand inhabitants does not affect any of these expectations. Table A.4 in the appendix shows the regression results in detail. This suggests that VHS education does not shift professional expectations on average.

All in all, we find no evidence that VHS courses affect either life goals, confidence in the future or professional expectations in a statistically significant manner. These findings suggest that non-formal education differs from formal education in the sense that it does not shift aspirations nor expectations on average. Formal education, on

Figure 7: The Effect of Course Exposure on Professional Expectations



Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: This figures shows the estimated ITT effects of VHS courses on various job-related expectations. Individuals rated the likelihood of various job-related events to happen in the next two years. We recoded the scale such that it goes from 0 to 100. Confidence intervals are shown at the 90 % level. Standard errors are clustered at county level. Job-related expectations were surveyed from 1992-94, in 1996, 1998, 1999, and 2001.

the other hand, has been found to raise aspirations (Clark et al., 2015). These higher aspirations, in turn, attenuate or even reverse the well-being effect of formal education. We suspect aspirations and expectations to be less affected by non-formal education, given that non-formal education does not lead to any degree or certification and may consequently matter less for positioning in social networks or for the labor market.

6.3 Are Effects the Same for Everyone?

So far, the estimates refer to the average causal effect of VHS education across all individuals. But focusing on this average could mask substantial heterogeneity across population subgroups, given that the benefits of adult education may not be uniform. Understanding which groups benefit relatively more (or less) from VHS education allows school managers to design courses valuable to previously underserved groups and target programs more effectively. It also informs about the degree to which VHS achieve their goal of providing adult education that is accessible for everyone.

Previous research has shown systematic differences in life satisfaction for example by religiosity (Lim and Putnam, 2010), income (Frijters et al., 2004b), and employment status (Hetschko et al., 2014). Table A.5 in the appendix finds corresponding differences across population subgroups also in our sample. Furthermore, participation in continuing

education in Germany varies by gender, employment status, income, age, and educational level (BMBF, 2003, 2015). We therefore distinguish respondents by gender, marital status, employment status, income, age, educational attainment, and church membership (see Table A.1 in the appendix for summary statistics, Table A.5 reports relative group sizes). To detect potential differences in the well-being effect across these groups, we extend the estimation model by including an interaction term:

$$SWB_{ict} = \alpha + \beta_1 \times courses_{c,t-1} + \beta_2 \times courses_{c,t-1} * D_{ict} + D_{ict} + \gamma X_{ict} + \delta_i + \delta_t + \epsilon_{ict}, \quad (4)$$

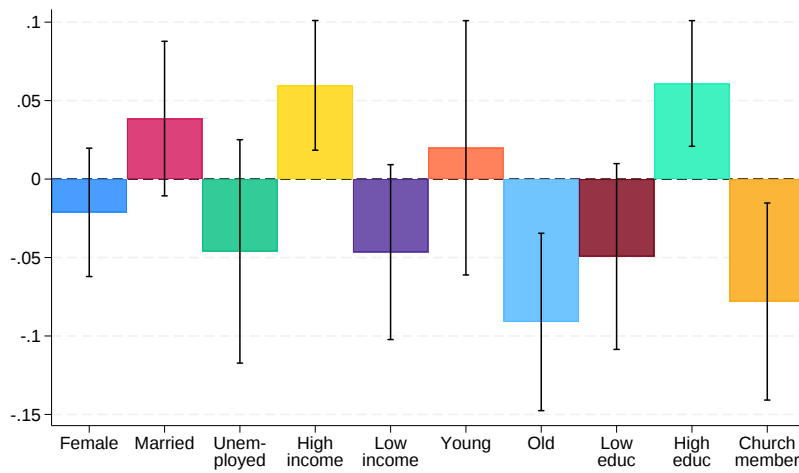
where D_{ict} stands for an indicator equal to one for the years t in which individual i belongs to a specific subgroup. The rest of the notation is identical to the main estimation model (see Equation 2). If the well-being effects of exposure to VHS courses differ across subgroups, we would find significant estimates for β_2 . Group differences may arise due to differences in what people infer well-being from but also from differential propensities to participate in adult education.

Figure 8 presents the estimates for β_2 for the various subgroups, thereby showing the differential well-being effect of VHS course exposure compared to the rest of the sample. Table A.6 in the appendix contains the estimation results in detail. For a range of subgroups, we find no evidence of heterogeneous effects: The estimation results indicate no significant differences in the well-being effect of VHS course exposure by gender or marriage status. While being unemployed itself is negatively associated with life satisfaction (significant at the 1 % level), the estimated interaction effect is insignificantly different from zero. This implies that unemployed individuals experience well-being gains comparable to those of other individuals.

With respect to income, we find evidence that the well-being effect is significantly larger for those belonging to the highest income quartile. Individuals with a monthly net household income of 4,300.87 Deutschmark (DM) and more belong to this group.¹⁰ The estimated interaction term is positive and significantly different from zero at the 10 % level. This indicates a significantly larger well-being effect for the richest 25 % of individuals compared to the rest. When looking at individuals belonging to the lowest income quartile, that is those having a monthly net household income of 2,200.31 DM and less, the estimated interaction term is negative but insignificantly different from zero. This suggests that low-income individuals benefit from VHS courses to the same degree like others. These findings coincide in parts with the fact that participation in continuing education increases with income (BMBF, 2015, p.32f). Moreover, they suggest that the VHS policies of low participation fees and, if needed, further financial support to cover them are effective instruments for expanding access to adult education for low-income

¹⁰For comparison, the GDP per capita in East Germany (excluding Berlin) increased from 14,587 DM in 1991 to 34,417 DM in 2001 (Statistische Ämter der Länder, 2025).

Figure 8: Differences in the Well-Being Effect Across Subgroups



Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: This figure shows whether and how the well-being effect of being exposed to an additional VHS course per thousand inhabitants differs across population subgroups. Individuals belonging to the top quartile of the net household income distribution ($\geq 4,300.87$ DM) are considered as having a high income, those belonging to the lowest quartile ($\leq 2,200.31$ DM) as having a low income. The age subgroups are defined analogously: Those aged 58 years and more belong to the oldest quartile of the age distribution in our sample and those aged 32 years and less belong to the youngest quartile. Individuals without secondary school-leaving degree are considered as having a low educational attainment. Individuals with tertiary education are considered as having a high educational attainment. Standard errors are clustered at the county level. Confidence intervals are shown at the 90 % significance level.

individuals.

Turning to the aspect of age, we find evidence that those belonging to the oldest quartile of the sample (58 years and older) benefit less from VHS courses than the rest. The estimated interaction effect for this subgroup is significantly negative (5 % level). For those belonging to the youngest quartile of the sample (32 years and younger), the estimated interaction term is positive, but close to zero and insignificant. We hence find no significant difference in the well-being effect between the youngest 25 % of individuals and the rest of the sample. These results coincide with the finding of BMBF (2015, p.37) that participation in continuing education is relative stable over the age distribution, but substantially decreases for those aged 55 to 64 years. In contrast to our sample, older persons are not considered in their survey.

Furthermore, we find evidence on heterogeneous effects by educational attainment. For highly educated individuals, that is those with a higher education degree, the estimated interaction effect is significantly positive (at the 10 % level). This means that individuals with a higher education degree experience larger gains in life satisfaction due to their exposure to VHS courses than individuals with a lower educational level. For individuals with a low educational attainment, that is those without a secondary school leaving degree, we find no evidence of differences in the well-being effect of VHS courses. The estimated interaction term for this subgroup is negative but not significantly different from zero. These findings coincide in parts with the fact that participation in continuing education increases with educational level (BMBF, 2015, p.33ff).

For the subgroup of church members, we find a negative interaction term that is significant at the 10 % level. This suggests that people that belong to a church benefit significantly less from available VHS courses than non-church members. One potential reason may be that churches themselves also offer non-formal adult education (e.g., Federal Association for Protestant Adult Education), so that church members may chose their educational offers over VHS courses. Alternatively, church members may also infer substantial well-being from their religion. As shown in Table A.5 in the appendix, the average life satisfaction of church members exceeds that of persons with no religious affiliation in our sample by almost 0.2 points.

Overall, we find some evidence of heterogeneous well-being effects of VHS course exposure across population subgroups. Individuals with high household incomes and higher education degrees experience significantly larger gains in life satisfaction, while older individuals and church members experience significantly smaller gains in life satisfaction compared to the rest. For VHS, this may raise the question whether courses are designed in a way that factually allows everyone to benefit. School managers may want to scrutinize how to reach disadvantaged population subgroups better. However, many of the imbalances typical for the German education system appear to be of a lower empirical importance for VHS, as the absence of differential effects for unemployed, low-income and low educated

individuals points out (see, for example, BMBF, 2022). Nevertheless, VHS education apparently does not counteract these imbalances neither.

6.4 Robustness Checks

Local Economic Activity. Our identification strategy assumes that individuals' exposure to VHS courses is orthogonal to their own well-being. Omitted variables may undermine this assumption, as long as they influence both individuals' life satisfaction and their exposure to VHS courses. Although the inclusion of year and person fixed effects in the model already reduces the probability of such a bias, we run additional tests to inspect the robustness of our results to the inclusion of such variables.

One potential driver of both life satisfaction and course numbers may be local economic activity. Unfortunately, the large restructuring of the East German administrative landscape following the reunification severely limits the availability of regional data, especially in the early 1990s. County-level measures of GDP, for example, are not available for a substantial part of the observation period. We therefore rely on three proxy measures of local economic activity: subsidies paid by local political institutions to VHS, the unemployed share of a county's population, and the surface structure of a county's area (Lehnert et al., 2023a). In the following, we discuss whether our results are robust to controlling for these proxy measure of local economic activity. If economic activity was a previously omitted key determinant for both life satisfaction and VHS courses, we would find insignificant well-being effects of VHS courses.

Local funding is defined as the subsidies paid by municipalities and the county. Principle components for both municipalities' and counties' budgets are trade and income taxes. If this local taxable capacity is positively associated with the subsidies paid to VHS, it could also drive course numbers. On the other hand, higher incomes are also associated with higher life satisfaction (see, for example, Frijters et al., 2004b). Subsidies paid by local authorities may therefore be a relevant variable in explaining both life satisfaction and course numbers. In fact, VHS do rely heavily on public funding. In our sample, subsidies paid by local political institutions finance on average 27.60 % of their budgets (see Table A.7 in the appendix). The rest is financed through participation fees, raised funds, and subsidies paid by the respective federal state. Over time, the importance of local subsidies in VHS budgets declined: After peaking at 36.37 % in 1991, this share declined and reached a minimum value of 23.85 % in 2000 (see Figure A.3 in the appendix). Given the simultaneous expansion of VHS courses, this suggests that local subsidies are not a key determinant of course numbers. The results of the robustness test support this view: When controlling for the logarithmized sum of local subsidies in VHS revenues, the estimated effect of VHS courses on life satisfaction increases from 0.03 points to 0.04 points (see Column 2 of Table 3). Controlling for local subsidies does not change the

Table 3: Controlling for Local Economic Activity

	Life satisfaction				
	(1)	(2)	(3)	(4)	(5)
Course exposure	0.03* (0.02)	0.04* (0.02)	0.06** (0.03)	0.03* (0.02)	0.06** (0.03)
Log of local subsidies		-0.01* (0.01)			-0.01 (0.01)
Unemployed population share			0.13 (0.57)		0.37 (0.60)
Surface shares				✓	✓
N	36,030	36,030	32,856	36,030	32,856
Adjusted R^2	0.50	0.50	0.51	0.50	0.51

Data Sources: VHS statistic, SOEP v38.1, BBSR, Rupieper & Thomsen (2025), Lehnert et al. (2023b).

Notes: This table reports the estimated ITT effect of an additional VHS course per thousand inhabitants on East Germans' life satisfaction, as surveyed between 1992 and 2001. All specifications control for the number of interviews participated in, socio-demographic characteristics, year fixed effects and person fixed effects. For convenience, Column 1 repeats the main estimation results. The baseline value for life satisfaction in 1990 is 6.57 on a scale from 0 to 10. Individuals were exposed to an average of 2.46 VHS courses per thousand inhabitants. The average share of subsidies in VHS' overall revenue is 27 %. On average, 9 % of a county's population are unemployed. As unemployment data is not available for 1991, the specifications controlling for the unemployed population share rely on a slightly smaller sample compared to the rest. Standard errors are given in parentheses and clustered at the county level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

estimated effect of VHS course exposure on life satisfaction qualitatively.

The second proxy measure of local economic activity is the share of unemployed persons in a county's population. Unemployment may have affected both life satisfaction as well as the demand for adult education. On average, 9 % of a county's population were unemployed according to the statistics of the Federal Employment Agency.¹¹ As county-level unemployment data is not available for 1991, the specifications controlling for the unemployed population share rely on a slightly smaller sample compared with the others. When controlling for the unemployed population share in a county, the estimated effect of VHS course exposure on life satisfaction increases to 0.06 points and is significantly different from zero at the 5 % level (see Column 3). Controlling for local unemployment does thus not change the estimated effect of VHS course exposure on life satisfaction qualitatively.

The third proxy measure of local economic activity is based on daytime satellite data that inform about the surface structure of counties. As some surface types are more closely related to economic activities than others, daytime satellite data can predict local GDP (Lehnert et al., 2023a). To minimize the noise that may result from that prediction, we control for the logarithmized surface shares instead. The estimation results of this specification, shown in Column 4, are basically identical to our main results. Lastly, we jointly control for all these proxy measures in Column 5. The estimation results of this specification are similar to those of the specification controlling only for the unemployment share, as an additional VHS course is found to increase life satisfaction by 0.06 points.

Overall, these results highlight the robustness of our results to the inclusion of various proxy measures of local economic activity, which supports the validity of the identification assumption. Across all specifications, the well-being effect of VHS courses remains significantly positive. In three out of four specifications, the effect even increases in size. In two out of four specifications, the effect increases in its statistical significance. This suggests that omitted variables related to local economic activity do not confound the estimated effect of VHS education on life satisfaction identified in our main analysis.

Alternative Clustering of Standard Errors. To further test the robustness of our results, we vary the clustering of standard errors. While our main analysis clusters standard errors at the county level, one could alternatively cluster them at the individual level. For convenience, Column 1 of Table A.8 in the appendix replicates the results from our main specification. The regression results shown in Column 2 rely on standard errors clustered at the individual level instead. As expected, only the standard errors change between the two specifications. When clustering at the individual level, the standard errors of the

¹¹You may note that this value differs from the unemployed population share according to the SOEP sample (see Table A.1). Differences between the two datasets may arise because the Federal Employment Agency does not include unemployed persons who participate in training or other active labor market policy programs in its unemployment statistics. Unemployed individuals interviewed for the SOEP may, however, still indicate being registered as unemployed while being in training.

majority of the covariates increase slightly. However, they still lead to the same conclusions regarding the statistical significance of the estimates. Also the estimated effect of exposure to VHS courses remains statistically significant at the 10 % level, showing that our results are robust to alternative ways of clustering the standard errors.

Treatment Effects at Different Levels of Exposure. As a sanity check, we estimate the effect of VHS courses on life satisfaction at different levels of exposure. The expectation is that the intention-to-treat effect increases with greater availability of VHS courses, as more people benefit. We estimate effects at different levels of course exposure using sample splits. Subsamples are defined based on the median of the course-exposure distribution, which equals 2.41 VHS courses per thousand inhabitants. Individuals with exposure at or below this threshold constitute the subsample with below-median course exposure. Individuals with greater exposure compose the subsample with above-median course exposure. Table A.9 in the appendix presents the estimation results. For convenience, Column 1 repeats the results of our main analysis. In the subsample with below-median course exposure, we find that VHS course exposure increases life satisfaction by 0.05 points. However, this effect is insignificantly different from zero and estimated with less precision than in the main results. In the subsample with above-median course exposure, an additional VHS course is found to increase life satisfaction by 0.7 points. This effect is statistically significant at the 5 % level and is substantially larger than the corresponding estimates in both the low-exposure subsample and the main analysis. These findings align with expectations and support the validity of the empirical approach.

Temporal Structure of the Model. Lastly, we assess the validity of the chosen temporal model structure by examining whether courses offered in the previous year are indeed those that matter for life satisfaction. For this purpose, we regress life satisfaction on future courses, contemporaneous course, last year's courses and courses from two years ago. Finding significant effects of future courses would raise concerns about reverse causality. This analysis also allows us to assess whether the well-being effects of adult education fade over time by comparing the estimates of last year's courses with those of courses offered two years ago.

Figure A.4 in the appendix presents the results of this exercise (see Table A.10 in the appendix for the detailed estimation results). Compared to courses from other years, last year's courses have the largest effect on life satisfaction across specifications. Their point estimates range from 0.06 to 0.11, implying a small increase in life satisfaction. These effects are significant at the 1 or 5 % level. Courses from two years ago are found to have smaller positive effects, which are however insignificantly different from zero in the three more conservative specifications. This coincides with the notion that the well-being effects of VHS courses fade over time. For courses that take place in the same year as life satisfaction is measured, we find small negative, yet insignificant, associations. This is plausible because many of these courses have not yet taken place at the time the SOEP

surveys life satisfaction. While VHS courses occur throughout the year, the majority of SOEP interviews are conducted in the first quarter of the year (see Figure A.2 in the appendix). For future courses, we find no significant correlations with life satisfaction in any of the specifications and varying signs of the point estimates. In our preferred specification, which includes the largest set of control variables, only last year’s courses significantly affect life satisfaction, increasing it by 0.06 points (significant at the 5 % level). In this specification, the estimates for the remaining course measures are all very small, statistically insignificant, and close to zero.

Cumulated Exposure. To further assess whether the well-being effect of adult education is only short-lived, we additionally estimate the effect of cumulated exposure to VHS courses on individuals’ life satisfaction. Insignificant estimates or smaller effects than those found in the main analysis would be consistent with the idea of fading effects. Table A.11 in the appendix reports the corresponding results. Across all specifications, the point estimate for cumulative course exposure is smaller than the corresponding estimate in the main analysis. In our preferred specification, the most conservative one, the point estimate is very close to zero and statistically insignificant. These results coincide with the notion that effects fade over time.

7 Conclusion

This paper studies the contribution of non-formal adult education to life satisfaction. Previous studies on this topic have documented small positive correlations between participation in adult education and life satisfaction, which, however, do not necessarily imply a causal effect. It therefore remained unclear whether adult education causes people to be happier or whether happier people are more prone to participate in adult education. Our study contributes to a better understanding of the causal effects of adult education by exploiting a natural experiment. To this end, the substantial, decentralized expansion of VHS courses in East Germany after reunification provides plausibly exogenous variation in course availability. We find that an additional VHS course per thousand inhabitants significantly increases life satisfaction by 0.03 points on average, corresponding to an increase of 0.46 % relative to the baseline and 1.7 % of a standard deviation. This small effect size is reasonable given that we estimate ITT effects. Accordingly, we find stronger (weaker) effects for groups known to participate more (less) in adult education across population subgroups. Among course participants, the ATT estimates suggest an increase in life satisfaction of 1.05 points, which is equivalent to a 16 % increase relative to the baseline and 58 % of a standard deviation.

Education affects life satisfaction by shaping aspirations and expectations, as well as actual living conditions. In contrast to aspirations, expectations also reflect the perceived probability of reaching a specific goal. While Clark et al. (2015) find that formal education

increases individuals' aspirations, offsetting about half of its effect on happiness, we find no corresponding effects of VHS courses on life goals, professional expectations or confidence in the future. Upward adjustments in aspirations may thus be typical of formal education but matter less in non-formal education. Social comparison facilitated by such courses may even lower aspirations. Whether learning leads to a degree may be a critical factor in education's effect on aspirations and expectations, given the importance of degrees as signals in the labor market and as positional goods. This suggests that the mechanisms shaping aspirations and expectations vary greatly across different types of education.

While our paper improves the internal validity of the evidence on the effects of non-formal adult education on life satisfaction, we remain cautious about the generalizability of our findings to other contexts. As Clark (2018) points out, well-being effects are often context-dependent. We expect this to hold for the well-being effects of education, given education's societal functions and determinants. Nevertheless, several takeaways emerge: Based on theoretical arguments, the well-being effects of non-formal adult education increase with the extent to which courses improve living conditions. For education providers, this highlights the importance of the practical applicability of learning content and demand-oriented course design. At a broader societal level, an equitable distribution of opportunities is critical to enable adults to improve their living conditions through lifelong learning.

Our results suggest that non-formal adult education yields larger well-being gains than other types of education. In contrast to the small positive effect of VHS courses found in this study, the related literature on the well-being effects on compulsory schooling remains inconclusive (see Section 2). Another study on adult education evaluating work-related training finds no significant impact on life satisfaction (Ruhose et al., 2020). So why does VHS education, but not work-related training or schooling, increase life satisfaction? One reason may be that non-formal education does not lead to a degree or certificate, and therefore may result in smaller or even no upward adjustments in aspirations. The emancipatory pedagogical tradition of VHS, the variety of course contents, and voluntary participation may be additional important features.

Given that non-formal adult education boosts life satisfaction, subsidizing lifelong learning can be justified not only on efficiency grounds, such as skill improvements and productivity enhancements, but also on welfare grounds. Providing opportunities for lifelong learning may be especially valuable in times of pronounced change and economic hardship, as in the case of East Germany after reunification. Depending on participation patterns and the distribution of well-being effects, equity considerations can provide an additional reason to subsidize lifelong learning. Policy makers may also be interested in investing in citizens' well-being for opportunistic reasons: In democracies, citizens' well-being signals the legitimacy of the government and holds a stabilizing potential (Hogwood, 2011). Furthermore, lower well-being is associated with a higher probability of voting for

populist parties (Burger and Eiselt, 2023), whereas higher well-being increases incumbents' reelection chances (Liberini et al., 2017) and citizens' political trust (Zhang et al., 2025).

The question remains how subsidies to non-formal adult education compare with their returns. In our sample, total costs per adult learner amount to 272.17 DM (median: 251.13 DM).¹² Of this amount, subsidies covered 53 % and participant fees 29 % on average, with the remainder coming from other funding sources. However, whether the induced well-being gains offset VHS subsidies depends on the valuation of well-being. We refrain from such a quantification exercise here, as traditional cost-benefit calculations reach their limits whenever it comes to the valuation of non-pecuniary benefits. Nevertheless, because life satisfaction is positively associated with many health outcomes (Diener et al., 2017), second-order effects may lead to additional, financial benefits in the health care system. In addition, adult education may generate further benefits by improving labor market integration (see, for example, Rupieper and Thomsen, 2025), enhancing social capital, and counteracting skill depreciation, thereby reducing social benefit payments. Ensuring continuous funding may therefore pay off from a social planner's perspective.

Especially in times of profound change, lifelong learning may play an important role in helping adults to maintain and build lives they value. The East German transformation lies in the past, but current megatrends such as AI, digitalization, globalization, and climate change continue to exert transformation pressures, highlighting the ongoing importance of lifelong learning. For adults, non-formal courses and training are easily accessible, low-cost means of adaptation. Weekly courses, such as those provided by VHS, are often compatible with adults' working lives and other responsibilities, given their modest time commitment. Therefore, we recommend that policymakers consider opportunities for continuing education, such as those provided by German VHS and other adult education centers worldwide, as relevant social infrastructure. To guide such policies, further research is needed on the causal effects, mechanisms, and distributional impacts of different forms of lifelong learning.

Declarations

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Conflict of Interest. The authors declare no competing interests.

Data Availability. The sensitivity of the data prohibits its public sharing. However, the VHS statistic, provided by the German Institute for Adult Education, is available upon application via <https://www.die-bonn.de/weiterbildung/statistik/auswertungsservice>.

¹²Authors' calculations based on the number of learners enrolled in courses and total expenditures. This includes expenses on personnel, employee training, building and room rentals, utilities, advertising, materials for teaching and learning, and operating expenses.

The SOEP-Core Remote Edition augments the standard SOEP data with information about the county of residence and can be accessed in secure data environments upon application to DIW Berlin. All remaining data are publicly available from the cited sources. Replication code is available from the corresponding author upon request.

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Appendix 1: Tables

Table A.1: Summary Statistics

	mean	sd	min	max	N
<u>Treatment Variables</u>					
Exposure to VHS courses	2.61	1.11	0	10	36,030
Participation probability	3.23	1.27	0	15	36,030
<u>Main Outcomes</u>					
Current life satisfaction	6.37	1.80	0	10	36,030
Confident about future	2.53	0.80	1	4	15,166
<u>Importance of Life Goals</u>					
Be able to afford something	3.08	0.61	1	4	6,163
Help others	3.12	0.60	1	4	6,154
Fulfill one's potential	2.87	0.76	1	4	6,137
Have success in the job	2.86	1.05	1	4	5,908
Have an own house	2.51	1.06	1	4	6,137
Have a happy marriage	3.51	0.86	1	4	6,117
Have children	3.26	0.89	1	4	6,087
Be socially and politically active	1.76	0.70	1	4	6,147
Be able to travel and see the world	2.45	0.79	1	4	6,164
<u>Probability of Job-Related Events</u>					
Looking for a new job	28.32	32.06	0	100	13,036
Job loss	36.19	26.12	0	100	13,007
Promotion	22.46	24.34	0	100	12,970
Self-employment	9.05	20.08	0	100	12,476
Other profession	18.15	24.99	0	100	13,013
Giving up paid employment	10.42	20.72	0	100	13,015

Table A.1: Summary Statistics (Continued)

	mean	sd	min	max	N
Demotion	20.26	23.10	0	100	12,928
<u>Socio-Demographic Controls</u>					
Household income	3,228.95	1,563.57	55	31,800	36,030
Age	49.32	17.55	19	98	36,030
Female	0.52	0.50	0	1	36,030
Married	0.63	0.48	0	1	36,030
Low educational level	0.41	0.49	0	1	36,030
Medium educational level	0.38	0.48	0	1	36,030
High educational level	0.21	0.41	0	1	36,030
Registered as unemployed	0.14	0.34	0	1	36,030
Church member	0.28	0.45	0	1	26,421

Data Sources: Soep v38.1, VHS, BBSR.

Notes: Sample covers the years 1990-2002. All variables are coded in such a way that higher values denote stronger exposure, higher life satisfaction, or stronger agreement. As some items were not asked every year, observation numbers may vary. Exposure to VHS courses is measured by the number of VHS courses per thousand inhabitants in a given county. Participation probability is proxied by the number of enrollments in VHS course divided by the county population. Expectations about the various job-related events refer to the next two years. Household income is the monthly net income, measured in DM. Based on the CASMIN classification, individuals are considered to have a low educational level when they lack a secondary school leaving degree. These individuals may still have basic vocational education. Individuals with a secondary school leaving degree are considered to have a medium educational level. A high educational level is assigned to individuals with tertiary education. As church membership was only surveyed in 1990, 1991, 1997, and 2003, we interpolate from these observations to the years inbetween.

Table A.2: Falsification Exercise

	Courses per thousand inhabitants in 1991	
	$\hat{\beta}$	SE
Current life satisfaction	0.014	0.010
Female	−0.009	0.015
Married	0.008	0.039
Age	−0.001	0.002
Log household income	−0.065	0.100
Low educational level	−0.035	0.045
High educational level	0.070*	0.040
Church membership	−0.020	0.055
Wald test of joint significance		0.909
p-value		0.514
N		3,504

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Note: The table shows the estimated association of 1991's local course availability with individuals' pre-treatment life satisfaction and further socio-demographic characteristics. Pre-treatment values were measured in 1990. A Wald test of joint significance shows that even taken together, these variables are not significantly correlated with the local course density in the following year. Coefficient and standard error of the constant are not shown. Standard errors are clustered at county level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.3: Effects of VHS Courses on the Importance of Various Life Goals

	Marginal effect of being exposed to an additional VHS course per thousand inhabitants				
	$\hat{\beta}$	SE	Baseline	R^2	N
Able to afford something	-0.02	(0.02)	3.09	0.76	6,163
Help others	-0.02	(0.02)	3.11	0.73	6,154
Fulfill one's potential	0.02	(0.03)	2.86	0.80	6,137
Success in the job	0.02	(0.04)	2.89	0.87	5,908
Have an own house	0.02	(0.03)	2.41	0.87	6,137
Happy marriage	0.01	(0.04)	3.50	0.87	6,117
Have children	0.00	(0.04)	3.25	0.82	6,087
Be socially and politically active	0.02	(0.03)	1.76	0.80	6,147
Able to travel and see the world	0.02	(0.03)	2.51	0.82	6,164

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: Table shows the marginal effect of being exposed to an additional VHS course per thousand inhabitants on the importance of various life goals. Individuals rated the importance of a specific life goal on a scale quite important (1) to very important (4). Each row presents the estimation results of a new specification and for the outcome stated in the first column. All specifications control for socio-demographic characteristics, person fixed effects and year fixed effects. The number of interviews participated in is omitted due to its strong collinearity with the year indicator. Standard errors are clustered at the county level and given in parentheses. In the observation period, the SOEP survey included questions about life goals only in the years 1992 and 1995. Therefore, the baseline indicates the mean importance of a specific life goal as of 1992.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Effects of VHS Course Exposure on Job-Related Expectations

	Marginal effect of being exposed to an additional VHS course per thousand inhabitants				
	$\hat{\beta}$	SE	Baseline	R^2	N
Looking for a new position	0.80	(0.97)	34.65	0.60	13,036
Job loss	0.15	(0.51)	46.85	0.59	13,007
Self-employment	-0.42	(0.42)	11.35	0.61	12,476
Change to other profession	-0.22	(0.70)	24.18	0.55	13,013
Giving up paid employment	-0.44	(0.57)	13.35	0.50	13,015
Promotion	-0.08	(0.59)	22.33	0.57	12,970
Demotion	0.17	(0.62)	21.58	0.49	12,928

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: Table shows the marginal effect of being exposed to an additional VHS course per thousand inhabitants on individuals' expectation that various job-related events take place in the next two years, as surveyed from 1992-94, in 1996, 1998, 1999, and 2001. Expectations are measured on a scale from 0 to 100, with higher values denoting higher expected probabilities. Each row presents the estimation results for a new specification with the outcome variable stated in the first column. All specifications control for the number of interviews participated in, socio-demographic controls, year fixed effects and person fixed effects. Standard errors are clustered at the county level and given in parentheses. Baseline values refer to 1990.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Average Life Satisfaction Across Population Subgroups

	Mean	Standard Error	Share (in %)
Female	6.37	0.01	52
Male	6.37	0.01	48
Married	6.37	0.01	68
Unmarried	6.35	0.02	32
Not registered as unemployed	6.51	0.01	86
Unemployed	5.48	0.03	14
Low income	5.96	0.02	19
Middle income	6.41	0.01	53
High income	6.80	0.02	28
Young	6.56	0.02	23
Middle aged	6.16	0.01	50
Old	6.50	0.02	27
Low educational level	6.26	0.02	35
Medium educational level	6.41	0.01	42
High educational level	6.49	0.02	23
Church member	6.49	0.02	20
No church member	6.30	0.01	53

Data Sources: Soep v38.1, VHS, BBSR.

Notes: Mean life satisfaction between 1992 and 2002 for various population subgroups. Higher values denote stronger satisfaction. Low income is defined by having a net household income located in the lowest quartile of the income distribution, that is $\leq 2,180.75$ DM per month. High income is defined by having a net household income in the highest quartile of the income distribution, that is $\geq 4,199.17$ DM per month. The age categorizations are also based on the quartiles of the age distribution: Young individuals are aged ≤ 32 years, old individuals are aged ≥ 58 years. Low educational levels are assigned to individuals without a secondary school-leaving degree. High educational levels are assigned to individuals with a higher education degree (also see Section 6.3). The last column indicates the share of each subgroup in the overall sample.

Table A.6: Heterogeneous Effects of VHS Course Exposure on Subjective Well-Being Across Population Subgroups

	Women	Married	Unemployed	High income	Low income	Younger	Older	Low educational level	High educational level	Church member
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Course exposure	0.04 (0.03)	0.01 (0.03)	0.04 (0.02)	0.02 (0.02)	0.05* (0.02)	0.03 (0.02)	0.07** (0.03)	0.05* (0.02)	0.02 (0.02)	0.06* (0.02)
Subgroup indicator	0.00 (.)	-0.08 (0.11)	-0.43*** (0.12)	-0.20* (0.08)	0.08 (0.09)	-0.04 (0.11)	0.49*** (0.10)	-0.16 (0.14)	-0.11 (0.15)	0.28 (0.16)
Interaction effect	-0.02 (0.02)	0.04 (0.03)	-0.05 (0.04)	0.06* (0.02)	-0.05 (0.03)	0.02 (0.05)	-0.09** (0.03)	-0.05 (0.04)	0.06* (0.02)	-0.08* (0.04)
Number of interviews	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Person fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	36,030	36,030	36,030	36,030	36,030	36,030	36,030	36,030	36,030	26,421
R ²	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: Standard errors are clustered at the county level. As gender is the only time-invariant subgroup indicator, it gets absorbed by the person fixed effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.7: Funding of East German VHS

	Share of Budget (in %)
Raised from SGB funds	6.99
Raised from federal funds	0.86
Raised from EU funds	1.55
Raised from other funds	3.18
Subsidies paid by local authorities	27.60
Subsidies paid by federal state	25.12
Participation fees	34.69
N	833

Data Sources: VHS, BBSR.

Notes: Table shows the share of various funding sources in the budget of East German VHS. Local authorities include municipalities and the county. The sample is limited to East German VHS during the expansion period (1991-2001) and consists of county-year observations. AS few East German VHS started to report with a delay, we have no VHS information for three country-year observations.

Table A.8: Alternative Clustering of Standard Errors

	Life satisfaction	
	SE clustered at county level	SE clustered at individual level
	(1)	(2)
Course exposure	0.03* (0.02)	0.03* (0.02)
Number of survey waves	-0.12 (0.10)	-0.12 (0.11)
Married	0.02 (0.07)	0.02 (0.08)
Log household income	0.50*** (0.04)	0.50*** (0.05)
Low educational level	-0.28** (0.11)	-0.28** (0.12)
High educational level	0.07 (0.11)	0.07 (0.12)
Registered as unemployed	-0.54*** (0.05)	-0.54*** (0.04)
Year fixed effects	✓	✓
Person fixed effects	✓	✓
N	36,030	36,030
R^2	0.59	0.59

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: The first column replicates the results from our preferred specification in the main analysis, where we cluster the standard errors at the county level. The second column shows the results of an alternative specification, which clusters the standard errors at the individual level instead. Standard errors are reported in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.9: Does Treatment Intensity Matter?

	Life satisfaction		
	Main	Course exposure...	
	results (1)	below median (2)	above median (3)
Course exposure	0.03* (0.02)	0.05 (0.08)	0.07** (0.03)
Number of survey waves	-0.12 (0.10)	-0.05 (0.18)	-0.06 (0.20)
Married	0.02 (0.07)	0.22* (0.12)	0.06 (0.10)
Log household income	0.50*** (0.04)	0.48*** (0.07)	0.49*** (0.07)
Low educational level	-0.28** (0.11)	-0.38* (0.20)	-0.35** (0.16)
High educational level	0.07 (0.11)	0.01 (0.16)	0.05 (0.21)
Registered as unemployed	-0.54*** (0.05)	-0.41*** (0.08)	-0.67*** (0.07)
Year fixed effects	✓	✓	✓
Person fixed effects	✓	✓	✓
N	36,030	18,027	18,003
R^2	0.59	0.62	0.66

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: Table shows the estimated marginal effect of an additional VHS course per thousand inhabitants on subsequent life satisfaction, as surveyed between 1992 and 2002. Column 1 replicate the estimates from the main analysis. Column 2 shows the estimated effect for individuals with a below-median VHS course exposure. Analogously, Column 3 shows the estimated effect for individuals with an above-median VHS course exposure. The median exposure is 2.41 VHS courses per thousand inhabitants. Standard errors are clustered at the county level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.10: Inspecting the Temporal Structure of the Model

	Life satisfaction				
	(1)	(2)	(3)	(4)	(5)
Future course exposure	−0.02 (0.04)	−0.03 (0.04)	−0.02 (0.04)	−0.02 (0.03)	0.02 (0.03)
Simultaneous course exposure	−0.05 (0.03)	−0.05 (0.03)	−0.04 (0.03)	−0.04 (0.03)	−0.01 (0.03)
Last year's course exposure	0.10*** (0.03)	0.11*** (0.03)	0.09*** (0.03)	0.08*** (0.03)	0.06** (0.03)
Course exposure two years ago	0.06* (0.03)	0.07** (0.03)	0.04 (0.03)	0.02 (0.02)	−0.01 (0.02)
Number of interviews		−0.01 (0.01)	−0.02** (0.01)	−0.04*** (0.02)	−0.35 (0.26)
Married			−0.18** (0.07)	−0.16** (0.07)	−0.01 (0.09)
Log household income			0.65*** (0.06)	0.64*** (0.06)	0.55*** (0.05)
Low educational level			0.08 (0.07)	0.09 (0.07)	−0.19 (0.15)
High educational level			−0.05 (0.07)	−0.04 (0.07)	0.08 (0.15)
Registered as unemployed			−0.88*** (0.08)	−0.89*** (0.08)	−0.57*** (0.06)
Year fixed effects				✓	✓
Person fixed effects					✓
N	24,099	24,099	24,099	24,099	24,099
Adjusted R^2	0.00	0.00	0.06	0.06	0.51

Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: The baseline value for life satisfaction in 1990 is 6.57 on a scale from 0 to 10. Standard errors are clustered at the county level and given in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.11: The Effect of Cumulated Exposure on Life Satisfaction

	Life satisfaction				
	(1)	(2)	(3)	(4)	(5)
Cumulated course exposure	0.00* (0.00)	0.02*** (0.01)	0.01** (0.01)	0.01 (0.01)	0.00 (0.01)
Number of interviews		✓	✓	✓	✓
Socio-demographic characteristics			✓	✓	✓
Year fixed effects				✓	✓
Person fixed effects					✓
N	36,030	36,030	36,030	36,030	36,030
Adjusted R^2	0.00	0.00	0.07	0.07	0.50

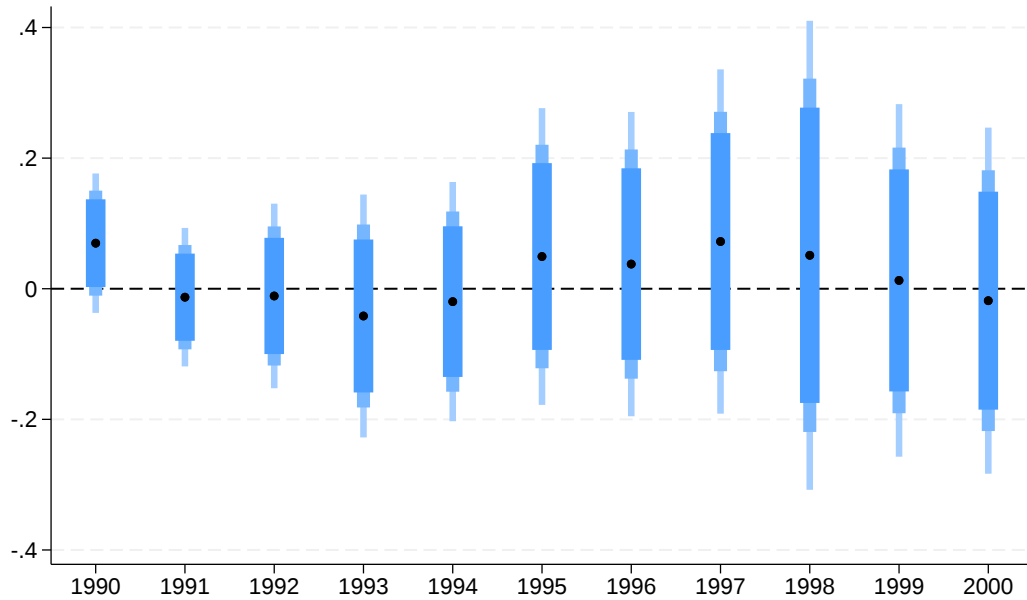
Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: The baseline value for life satisfaction in 1990 is 6.57 on a scale from 0 to 10. On average, individuals had a cumulated exposure to 9.90 VHS courses per thousand inhabitants. Standard errors are given in parentheses and clustered at the county level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix 2: Figures

Figure A.1: Correlation Between High Educational Attainment and Next Year's Exposure to VHS Education

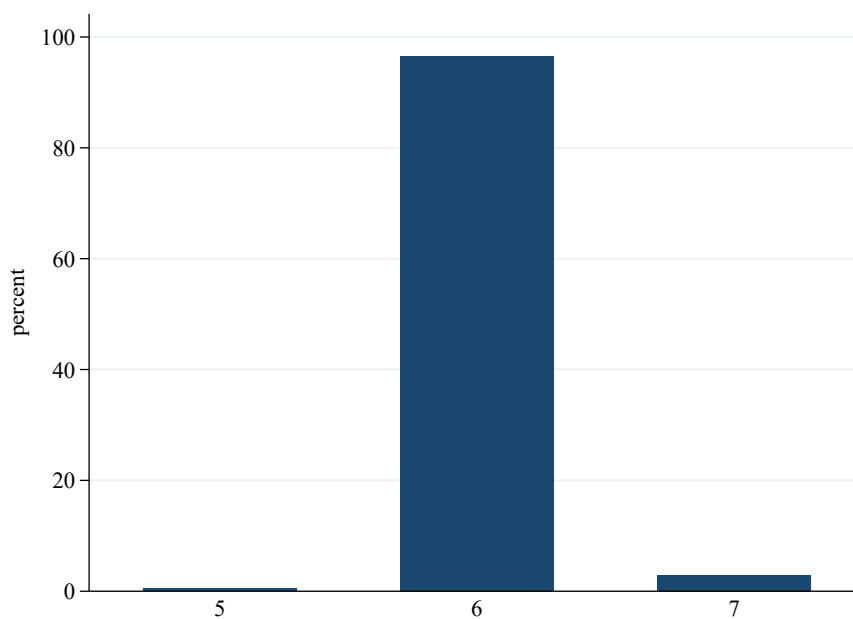


Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: This figure shows the correlation between individuals' attainment of tertiary education and their later exposure to VHS courses. The estimated model corresponds to the one estimated for testing the plausibility of the identifying assumption, Equation 3. For 1990, the correlation is therefore identical to the association between high educational attainment and later course exposure in Figure 5. Correlations for later years stem from estimating the same regression model analogously for later years. Confidence intervals are shown at the 90, 95 and 99 % level. Paler bars refer to higher significance levels. Standard errors are clustered at county level.

Figure A.2: In Which Months Did the East German SOEP Interviews Take Place?

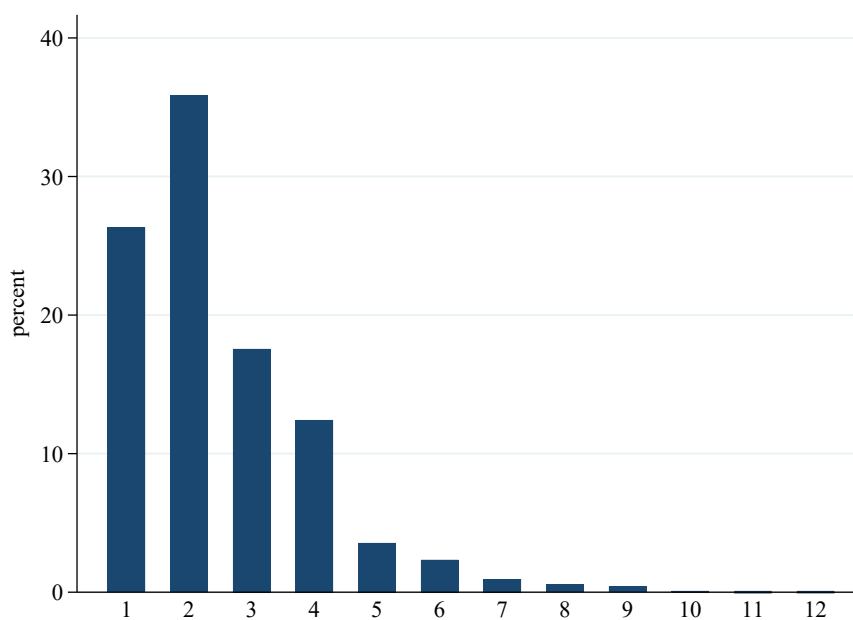
(a) In 1990



Data Sources: SOEP v38.1.

Notes: This figure shows the distribution of interview months among East German SOEP respondents in the wave of 1990.

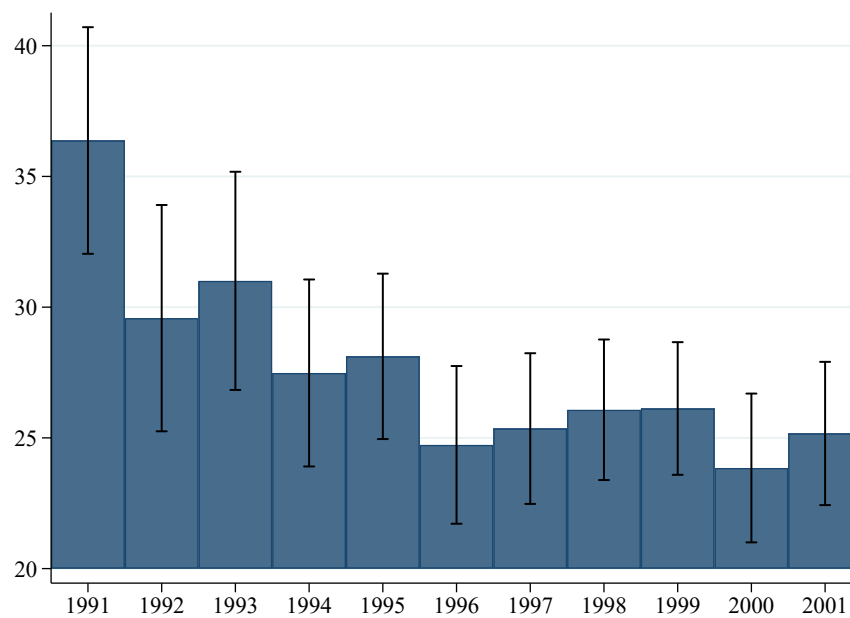
(b) Between 1991 and 2002



Data Sources: SOEP v38.1.

Notes: This figure shows the distribution of interview months among East German SOEP respondents between 1991 and 2002.

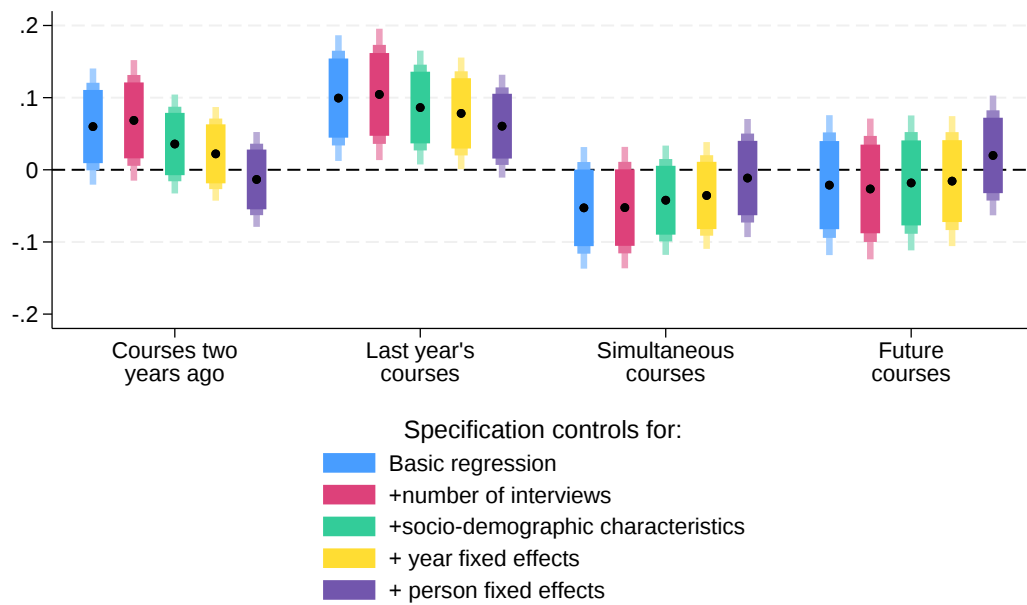
Figure A.3: Share of Local Subsidies in VHS' Budgets



Data Sources: VHS, BBSR.

Notes: Local funding subsumes subsidies paid by municipalities and counties. Confidence intervals are shown at the 95 % level.

Figure A.4: Inspecting the Temporal Structure of the Model



Data Sources: VHS statistic, SOEP v38.1, BBSR.

Notes: Estimation results from regressing individual well-being on future course exposure, simultaneous course exposure, course exposure a year ago, and course exposure two years ago. Standard errors are clustered at the county level. Confidence intervals are shown at the 90, 95 and 99 % significance level. Paler confidence intervals refer to higher significance levels.