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IZA DP No. 18186

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ABSTRACT

Worker Beliefs About Firm Training*

Firm training is key to meeting changing skill demands, yet little is known about the role of workers' beliefs in shaping training participation. In a survey of 3,701 workers in Germany, we document that they expect substantial returns to firm training – both in terms of earnings and non-pecuniary outcomes such as promotion chances, job task complexity, or enjoyment. These beliefs predict actual and intended training participation. Lower-skilled workers anticipate smaller non-pecuniary returns, partly explaining their lower uptake. An information treatment addressing return beliefs significantly increases training intentions among lower-skilled workers, suggesting that targeting beliefs may help narrow participation gaps between lower- and higher-skilled workers.

JEL Classification: J24, J31, D83, I21

Keywords: beliefs, firm training, skill mismatch, human capital, survey

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1 Introduction

Technological change constantly alters the demand for the skills needed to perform a broad range of job tasks on the labor market, requiring workers to acquire new skills throughout their careers (Autor et al. 2003; Deming and Noray 2020; Autor et al. 2024). Classic models of human capital depict the accumulation of these skills through both formal schooling and on-the-job learning, much of the latter taking place within firms (Becker 1964; Mincer 1974; Acemoglu and Pischke 1998). The empirical importance of firm training, measured in terms of its contribution to the total human capital stock, is substantial and at least rivals that of formal schooling (Black et al. 2023). However, firm training participation varies widely across workers, and the underlying determinants of firm training decisions at the worker level are not fully understood. In particular, models of human capital investment posit that workers trade-off expected costs and returns to determine their optimal level of training investments (e.g., Ben-Porath 1967; Sanders and Taber 2012). Given the uncertainty of future costs and benefits, workers' beliefs about returns to training are crucial determinants of their investment decisions. However, little is known about how these beliefs vary across workers and the extent to which they explain variation in firm training participation.

This paper investigates workers' beliefs about the (non-)pecuniary returns to firm training, and how they relate to training participation. We implemented an online survey in a representative sample of workers in Germany aged between 25 and 55 years ($N = 3,701$) in 2024. To elicit return beliefs, we employ hypothetical investment scenarios (e.g., Dominitz and Manski 1996; Jensen 2010; Attanasio and Kaufmann 2014), asking workers to envision their careers six years later in two scenarios: one with annual firm training lasting two weeks and another without. We subsequently elicit workers' expected earnings in both scenarios, along with their subjective probabilities that various non-pecuniary career outcomes will materialize. For example, workers indicate how likely they believe it is to experience increased workplace stress, enjoy their work tasks, or quit their job. Our approach to eliciting subjective beliefs about firm training helps overcome a common identification problem in observational data. Specifically, observed training choices alone do not reveal the underlying decision process, as they are consistent with multiple combinations of preferences and beliefs. This makes it difficult to isolate the role of beliefs in determining training participation (Manski 2004).

In addition, we study whether differences in beliefs can explain lower firm training participation observed among lower-skilled compared to higher-skilled workers. Previous literature has established these differences (Bassanini et al. 2007; Fouarge et al. 2013; Lergetporer et al. 2023), but little is known about their determinants. This is despite the fact that replacing depreciated human capital is particularly important for lower-skilled workers, who are most vulnerable to adverse labor market outcomes due to skill-biased technological change (Goos et al. 2014).

Besides providing a descriptive analysis of existing skill gaps in training participation and beliefs, we also present experimental evidence on whether addressing training beliefs

can influence gaps between lower-skilled and higher-skilled workers' intended training participation. Our light-touch intervention informs workers about the career benefits of training and the effectiveness of training for acquiring new skills, directly addressing known barriers to participation among lower-skilled workers (Osiander and Stephan 2018).

We start by documenting that workers perceive substantial positive career returns, both pecuniary and non-pecuniary, to participating in firm training. On average, workers expect their earnings six years later to increase by 8.6% through firm training. These return beliefs are slightly lower but broadly consistent with estimated earnings returns to firm training from observational data (e.g., Guo et al. 2024), suggesting that workers' average beliefs are generally well-calibrated. However, there is considerable heterogeneity in these expectations, with nearly half of the sample expecting no returns. Additionally, workers expect substantial non-pecuniary career returns. Specifically, they expect an 8 percentage points higher probability of having a successful career with training than without, a 10 percentage points increase in promotion probability, and a 3 percentage points reduction in the risk of job loss. Beyond these career expectations, they expect training to increase the probability of performing complex tasks by 14 percentage points, increase task enjoyment by 4 percentage points, and raise work-related stress by 2 percentage points. Differentiating by the type of skills that firm training targets (e.g., soft skills, IT, or administrative skills), we show that both pecuniary and non-pecuniary return beliefs are broadly similar across training contents. This suggests that workers' average expected returns to training are general in nature, rather than driven by specific types of training.

Investigating the predictive power of return beliefs for intended firm training participation, we show that most beliefs are significantly correlated with training intentions. This relationship persists even after controlling for a wide range of correlates of firm training participation, such as worker and firm characteristics, as well as detailed information about training characteristics. Lending support to the validity of our training-intentions measure, we find similar patterns when analyzing actual past training participation instead of intended future participation.

Next, we turn to differences between higher and lower-skilled workers. Descriptively, lower-skilled workers have much lower rates of both realized (67% vs. 46%) as well as intended (38% vs. 26%) firm training participation.[1] In terms of beliefs, we do not find differences in expected relative earnings returns between groups. However, lower-skilled workers perceive lower non-pecuniary returns to firm training than higher-skilled workers. For example, while higher-skilled workers expect the probability of professional success to increase by almost 10 percentage points with firm training, this number amounts to merely 5.5 percentage points among lower-skilled workers. Strikingly, while lower-skilled workers barely expect the probability of enjoying workplace tasks to increase through firm training, higher-skilled workers expect returns of more than 7 percentage points in this dimension.

[1]The lower rate of intended compared to realized training participation is likely due to the fact that we explicitly elicited intended participation for training with a minimum duration of 40 hours, whereas no such threshold applied to realized participation.

They also expect their promotion probabilities to increase by 2.3 percentage points less than higher-skilled workers. Differences in beliefs account for approximately 12% of the skill gap in intended training participation.

These patterns suggests that beliefs are a major determinant of workers' firm training decisions. To move beyond descriptive evidence, we next explore the causal relationship between worker beliefs and training intentions in a simple information-provision experiment (Haaland et al. 2023). In the experiment, we inform a randomly selected treatment group about the career benefits of training and its effectiveness for acquiring new skills, before eliciting training intentions as in the uninformed control group. We find that addressing worker beliefs through information provision significantly increases their training intentions, regardless of whether workers have to pay for part of the training costs themselves. On average, the information treatment significantly increases workers' stated probability to participate in firm training the following year by more than 2 percentage points. Importantly, this effect is primarily driven by lower-skilled workers, whose treatment-induced increase in training intentions is about 3 percentage points – roughly double that of higher-skilled workers. Therefore, this proof-of-concept experiment shows that addressing workers' beliefs about firm training can causally narrow the skill gap in training intentions.

We contribute to three strands of economic research. First, we add to the literature studying the determinants and consequences of firm training participation (see Black et al. 2023 for a comprehensive review). Regarding worker demographics, younger and more educated workers exhibit the highest training participation rates.[2] Those in skill-intensive occupations also participate more frequently, implying sizable gaps between lower- and higher-skilled workers. Our survey data replicates these associations. Beyond demographics, Caliendo et al. (2020) and Caliendo et al. (2023) study how workers' internal locus of control and risk tolerance relate to training participation, finding that both traits are positively associated with it. In contrast, empirical evidence is largely lacking on whether workers' beliefs and expectations about firm training – which are key primitives in models of human capital investment (Ben-Porath 1967; Sanders and Taber 2012) – influence training participation.[3] We contribute to this literature by studying firm training from a new angle, specifically by examining a broad set of (non-)pecuniary return beliefs as potential determinants.

Turning to the consequences of firm training participation for workers, a related strand of research shows that training can increase productivity, promotion probabilities, and to a lesser extent, wages (Bartel 1995; Konings and Vanormelingen 2015; Adhvaryu et al.

[2]On the firm side, workers in larger and more innovative firms show higher participation rates (e.g., Bassanini et al. 2007). Recent papers show in addition that manager characteristics are an important determinant of training participation (Caliendo et al. 2024; Diaz et al. 2025; Caliendo et al. 2025).

[3]Recently, some papers have studied how workers' beliefs about automatability of their occupations influences their training intentions, generally finding a positive association (e.g., Innocenti and Golin 2022; Golin and Rauh 2022; Arntz et al. 2023; Lergetporer et al. 2023). Although these studies focus on beliefs within the context of firm training as we do, they address a different research question. Rather than examining beliefs about firm training directly, they investigate beliefs about the automatability of occupations, which may influence training participation.

2023). While workers at risk of automation are generally less likely to participate in training (Heß et al. 2023), Guo et al. (2024) find that training participation reduces their automation risk. Building on this evidence, we investigating workers' *beliefs* about such returns to firm training across various dimensions, and how beliefs influence training intentions and participation.

Second, our paper is related to the literature investigating the role of subjective expectations and beliefs as determinants of economically relevant life choices, particularly human capital investment decisions (e.g., Wiswall and Zafar 2021; see Giustinelli 2023 for an extensive review). This research largely shows that students' and parents' expectations about monetary returns and costs have only limited explanatory power for schooling and college choices (e.g., Wiswall and Zafar 2015; Lergetporer et al. 2021). Instead, non-pecuniary factors like the expected enjoyment of studying are the predominant drivers of educational decision and disparities across sociodemographic groups (e.g., Zafar 2013; Giustinelli 2016; Baker et al. 2018; Boneva and Rauh 2021). In contrast to this vast literature focusing on formal schooling and college choices, the role of workers' beliefs in explaining firm training decisions has not yet been studied. Importantly, insights on the determinants of schooling decisions are not readily transferable to firm training decisions, as they represent conceptually different types of human capital investment decisions, a distinction we elaborate on in Section 2. We address this research gap by directly measuring workers' beliefs about (non-)pecuniary returns to training and examining their impact on training intentions and participation.

Third, we contribute to a recent literature strand in labor economics that examines economic beliefs of workers and their relation to labor market behavior and outcomes. Contrary to standard labor market models which assume that workers have accurate beliefs (e.g., Stigler 1961) several papers have documented that workers have imperfect knowledge of important labor market facts. For example, workers often hold incorrect beliefs about the expected duration of unemployment (Mueller et al. 2021), the wage distribution within their own firm (Cullen and Perez-Truglia 2022), or the external wage distribution that determines their outside options (Jäger et al. 2024). Evidence also shows that providing factual information to workers can affect their labor market expectations and (intended) behavior (e.g., Card et al. 2012; Conlon et al. 2018; Belot et al. 2019; Jäger et al. 2024; Roussille 2024). We expand this literature towards the domain of firm training by studying workers' (non-)pecuniary return beliefs and their relationship to training intentions and behavior.

The remainder of this paper is structured as follows. Section 2 outlines our conceptual considerations and presents institutional background information on firm training in Germany. Section 3 introduces our survey instrument, and Section 4 presents our results. Section 5 provides a discussion and concludes.

2 Conceptual Considerations and Institutional Background

In this section, we first discuss the importance of firm training for a country's overall human-capital stock and how it differs from other forms of human capital investments (Section 2.1). Then, we provide an overview of the institutional framework governing firm training in Germany (Section 2.2).

2.1 Conceptual Considerations

Firm training, or on-the-job training provided by employers, is crucial for workers to acquire human capital, rivaling the importance of formal schooling at primary, secondary, and tertiary levels. The immense economic importance of firm training is evident not only from its prevalence — with a large portion of the workforce in many countries participating annually (e.g., 66% in the U.S., or 60% in Germany; Black et al. 2023).[4] The considerable resources that firms and workers invest in training, both in terms of direct costs and the opportunity costs of time, also indicate its substantial economic value-added. Indeed, firm training has been shown to boost productivity and wage growth for workers throughout their careers and to mitigate adverse effects of technological change (Konings and Vanormelingen 2015; Battisti et al. 2023). Similarly, firms benefit from firm training in multiple ways: it enhances productivity (Dearden et al. 2006; Bartel 1995; Adhvaryu et al. 2023), reduces absenteeism and turnover (Diaz et al. 2025), and frees up managerial resources as trained workers require less supervision (Espinosa and Stanton 2022). Additionally, firms commonly rely on training as a strategy to address widespread shortages of skilled labor (e.g., Pfeifer and Backes-Gellner 2018; Blatter et al. 2016; Baier et al. 2025). Surprisingly, given its economic significance, the body of economic research on firm training is relatively modest and is dwarfed by the much more extensive literature on all aspects of formal schooling – a point recently highlighted by Black et al. (2023).

The relative scarcity of research on firm training is *not* because findings from schooling research would be directly applicable to modeling workers' training decisions. Instead, fundamental conceptual differences between formal schooling and firm training demand independent investigation into firm-training decisions. A primary structural difference is that while formal schools typically share key features such as the duration and certificates awarded, firm training is markedly more heterogeneous. It is typically organized in a decentralized, less standardized manner, leading to variation in duration, content, or certification across training programs. This introduces challenges in defining and measuring firm training that are not encountered with formal schooling (see Black et al. 2023), an issue which we revisit when introducing our survey instruments in Section 3.

Second, from a choice-theoretic perspective, the framework governing workers' training decisions differs markedly from students' schooling choices. Training decisions typically

[4]These percentages refer to workers who have engaged in informal firm training, which is training without formal certification, at least once over the past 12 months.

recur throughout a worker's career, representing a series of interdependent, repeated choices. By contrast, schooling decisions, once made, generally establish the educational trajectory for several years. Moreover, because firm training inherently occurs while employed, the opportunity cost structure of these training decisions differs from that of schooling choices, as the next best alternative — continuing to work — is immediate and salient.[5]

A third difference between on-the-job training and formal schooling is the importance of firms in determining their workers' training participation. Firms play a central role in providing and financing training, as evidenced by the fact that they cover the cost of more than 90% of informal, non-certified training undertaken by employees across OECD countries (Black et al. 2023). This raises the question of how much influence firms versus workers have in the decision-making process regarding training participation. Traditionally, models of firm training treat it primarily as a decision for firms, emphasizing firm-specific returns to certain types of workers' skills (Becker 1962; Acemoglu and Pischke 1998; Acemoglu and Pischke 1999; Autor 2001). When training enhances skills that are predominantly firm-specific and not easily transferable, firms have strong incentives to invest in training to realize productivity gains (Becker 1964; see Leuven 2005 for a review). However, firms have also been shown to invest in general skills of their workers. This investment behavior can be rationalized, for instance, through the presence of labor market frictions like wage compression (Acemoglu and Pischke 1999; Pfeifer 2016). Consistently, 83% of workers in our survey report that the skills they acquired through firm training were at least partly transferable to other firms.

While firms play a crucial role in facilitating and funding training, the influence of workers in the decision-making process is also important, typically determining the actual uptake of training opportunities. Workers have economic incentives to acquire (general) human capital through training to benefit from the resulting productivity gains. Consistently, recent theories model firm training as joint decisions of firms and workers, with workers participating in training if it yields positive private returns (e.g., Caliendo et al. 2020). Our survey data underscore the role of worker preferences in shaping firm training participation: two thirds report having initiated their most recent firm training, either independently or in coordination with their employer.[6] This raises the central empirical question we address in this paper: How do workers' subjective beliefs about returns to training – theorized as a key determinant of training choices (Caliendo et al. 2020) – shape training decisions?[7]

[5]Another form of human capital accumulation after schooling is learning-by-doing (see, e.g., Blandin 2018 and Arellano-Bover and Saltiel 2024). Given its informal and spontaneous character, learning-by-doing is very hard to measure. It also does not involve foregone production, leading to different incentive structures compared to firm training. Therefore, we do not consider it in this paper. Skill acquisition in adulthood also takes place via government-sponsored active labor market programs to unemployed workers (e.g., Katz et al. 2022). For a summary of this literature, see McCall et al. (2016).

[6]Furthermore, one in four workers reports that a past training request was denied by their supervisor, highlighting workers' active pursuit of training opportunities – even if not always successful.

[7]Caliendo et al. 2020 argue theoretically that workers' return beliefs are a key determinant of training choices. However, they do not directly measure expected returns from training as we do, but instead proxy them with workers' locus of control.

2.2 Institutional Background: Firm Training in Germany

To set the stage, this section presents key stylized facts about training in Germany. We establish these facts using the Adult Education Survey (AES), a key data source for measuring training participation across Europe. The AES provides standardized and comparable training measures, is conducted regularly, and is widely used by policymakers and researchers. It collects information on various forms of further training, including firm training (BMBF 2024). In Germany, the AES is conducted every two to three years. This probability-based survey collects data from a representative sample of the German population aged 18 to 69 (N = 9,820 in the latest 2022 wave). It assesses firm training participation over the past 12 months, defined as *any training activity that occurs entirely or predominantly during working hours or where the employer covers direct training costs.* This includes both in-house training programs and external courses provided by third parties (BMBF 2024). We adopt this definition of firm training throughout this paper.[8]

Firm training differs from more formal types of training, such as technical degrees or apprenticeship programs, which also partly take place within firms. These programs are "classical" professional degrees, combining firm-based training with school-based education. They last more than six months and lead to an officially recognized qualification. As such, they mostly cater to younger individuals, making them less common across the entire workforce. In contrast, firm training is typically shorter in duration, often lasting just a single day and is designed to support ongoing skill development throughout the career, making it more widespread across all age groups (BMBF 2024).

According to the 2022 AES, 66% of employees in Germany reported participating in at least one firm training activity over the past twelve months.[9] Substantial evidence shows that participation in firm training is heterogeneous across worker subgroups. In particular, workers in occupations demanding lower skills, older workers, those in precarious employment, and those holding jobs with high automatability are less likely to participate. Conversely, employees in the public sector, those in higher professional positions, with advanced education degrees, on permanent contracts, or in larger firms are more likely to participate. Participation rates are similar between men and women, between employees in eastern and western Germany, and between part-time and full-time workers (Heß et al. 2023; BMBF 2024). Reassuringly, these patterns of heterogeneity are largely reflected in our

[8]The AES also measures other forms of further training, namely individual job-related training (e.g., self-paid certificate courses or evening seminars), and non-occupational training (e.g., cooking classes or language courses for travel), as well as informal learning from colleagues or supervisors, which typically occurs in spontaneous, one-to-one interactions. We disregard these additional training types, as their greater heterogeneity in participation motives and barriers makes it harder to measure beliefs consistently. We focus on firm-provided training, as it is both the most common and economically most relevant form of further training.

[9]This participation rate refers to employees aged 18-69 working full- or part-time. Our survey reports a comparable rate of 56% over the same period. Differences may arise from the more detailed measure in the AES, which includes up to 16 types of training activities and likely results in higher reporting compared to our shorter survey instrument. In addition, our sample is restricted to employees aged 25-55 and is slightly more educated than the general population (see Appendix Table A.1).

firm training measures, underlining the validity of our survey data (see Section 3.2).

Firm training courses are typically quite short: among employees surveyed in the AES, 47% of their courses span only a few hours. Average course duration is 23 hours, with a median duration of 8 hours. Only 9% of training activities exceed 40 hours. The majority of firm training courses (71%) is conducted by the firms themselves, while the remaining share is provided by third-party institutions, such as chambers of commerce, industry associations, or external training providers (BMBF 2024). Unlike formal schooling, firm training tends to focus on applied, job-relevant skills. The content varies widely, ranging from automation technology courses for electricians to diversity training for managers and general digital skills training for office staff. A representative firm-level survey conducted in 2020 also reflects this diversity, showing that most training hours are invested in technical, practical, and job-specific skills, followed by training in customer orientation, general IT skills, problem-solving and teamwork skills (Destatis 2022).

3 The Survey

This section introduces our survey. We first outline our data collection process (Section 3.1). Then, we explain how we measured firm training intentions and realizations (Section 3.2), as well as workers' beliefs about returns to firm training (Section 3.3). Finally, we describe our randomized information-provision experiment that tests how addressing worker beliefs can causally affect training intentions (Section 3.4).

3.1 Data Collection

We conducted our online survey in May 2024 with a sample of 3,701 employed workers in Germany.[10] Participants completed the survey on their own devices, with a median response time of 16 minutes. Due to our focus on human-capital investment decisions, we restricted our sampling to those aged between 25 and 55 years who work at least 15 hours per week.[11] Respondents were recruited via the survey company Talk Online to represent average workers in Germany in terms of age, gender and state of residence.

Table 1 displays basic sample characteristics. Average age is 40.8 years, with 50% of the sample being female. On average, workers work 36.4 hours per week; 21% are employed part-time (i.e., working less than 35 hours per week). Regarding professional degrees, 35% hold a vocational degree, 16% an advanced vocational degree[12], and 45% a university degree.

[10] Online samples like ours have become a standard data source in economic research (Stantcheva 2023), and have been shown to represent the general population well (Grewenig et al. 2023).

[11] We disregard workers aged over 55 years because their impending retirement limits their incentives for human capital investments. For instance, Battisti et al. (2023) find that workers older than 55 fail to upgrade to more abstract jobs upon technological change. Similarly, individuals working less than 15 hours per week are not included in our sample due to their limited labor market attachment, which limits their firm training incentives and opportunities.

[12] Advanced vocational degrees include those from a technical school (*Fachschule*), master craftsman school (*Meisterschule*), technician school (*Technikerschule*), vocational academy (Berufsakademie), or professional

Workers report an average firm size of 453 employees, average tenure within the firm of 10.8 years, and average gross monthly earnings of 4,670 €.

In our analysis, we classify respondents as *higher-skilled* or *lower-skilled* based on a combination of their occupation's skill requirement level and their highest professional degree.[13] Following Christoph et al. (2020), we classify workers as higher-skilled if their occupation mainly involves complex specialist tasks (skill level 3) or highly complex tasks (skill level 4), and they hold a technical school degree or a university degree. This classification applies to 46% of our sample. The remaining 54% are classified as lower-skilled. These are workers in occupations that mainly involve unskilled tasks (skill level 1) or professionally oriented tasks (skill level 2), or with at most a vocational degree.[14] Appendix Table A.2 provides a descriptive comparison of higher- and lower-skilled workers.

To gauge the representativeness of our data, Appendix Table A.1 compares the characteristics of our sample (column 1) to the population of employees in Germany (column 2), using data from the German Federal Employment Agency (BA 2024). Confirming that our sampling strategy was successful, both datasets closely align in terms of the stratification variables age, gender and federal state of residence. Some differences emerge for occupational characteristics, which were not used for stratification. Specifically, our sample includes fewer workers in goods production, and more in business and IT compared to the population of German workers. Additionally, our sample includes fewer workers performing unskilled tasks, and has a higher share of full-time employment. While we do not claim representativeness along these dimensions, it is noteworthy that our diverse sample broadly captures the occupational diversity of the general workforce.

The survey structure is depicted in Appendix Figure D.1. Respondents first provide basic demographic information and details about their job characteristics. We then elicit their intentions to participate in firm training in the future and their subjective beliefs about (non-)pecuniary returns to firm training. Next, we elicit their actual firm training participation over the past 12 months, a standard reference period for such questions. We subsequently conduct our randomized information-provision experiment to assess how addressing workers' beliefs can causally affect training intentions. Finally, we elicit respondents' risk and time preferences, along with their self-assessed response reliability

academy (*Fachakademie*).

[13]To measure occupations' skill requirement levels, we use the levels defined in the German Classification of Occupations 2010 (KldB 2010), which closely aligns with the International Standard Classification of Occupations (ISCO). To elicit these classifications, respondents selected their occupation from ten major groups and, if not listed, entered it in an open text field. After hand-coding the latter, occupational classifications are available for 99% of the sample.

[14]Note that workers in occupations with skill levels 3 or 4 may still be classified as lower-skilled if their most advanced professional degree is a vocational degree or less. This applies to 11% of our sample; 7% have skill level 3 and the remaining 4% skill level 4. Appendix B presents robustness checks using an alternative classification, where the 4% of respondents in occupations requiring skill level 4 are classified as higher-skilled, regardless of their highest professional degree. Reassuringly, the results remain robust under this definition, although some of the differences between higher- and lower-skilled workers become somewhat smaller in absolute terms.

(Dohmen and Jagelka 2024), to account for measurement error in our robustness analysis.

TABLE 1. Respondent characteristics

	(1) Mean	Std. Dev.
Age	40.78	8.51
Female	0.50	0.50
Weekly hours	36.35	6.00
Weekly hours <35	0.21	0.40
Higher-skilled	0.46	0.50
Professional Degree		
Vocational degree	0.35	0.48
Advanced vocational degree	0.16	0.37
University	0.45	0.50
None/other	0.04	0.19
Number of workers at firm	452.95	411.84
Years at firm	10.78	9.20
Gross monthly earnings	4669.84	2553.91

Notes: N = 3,701. This table reports sample characteristics. Columns (1) and (2) report means and standard deviations. Gross monthly earnings are in full-time equivalents and winsorized from below at the minimum wage (2,135 €) and from above at the 98th percentile of the German wage distribution (14,583 €).

3.2 Measuring Actual and Intended Firm Training Participation

To provide a comprehensive picture of how workers' beliefs shape training decisions, we measure both actual participation in the past 12 months and intended future participation. Self-reported survey questions like ours are widely recognized as the primary empirical method for measuring firm-training participation. Unlike formal schooling, firm training is a heterogeneous, non-standardized form of education: its content, duration, and level of formalization vary substantially across regions, firms, and individual workers. This heterogeneity makes accurate measurement of training activities through administrative data challenging. Worker surveys are therefore essential for capturing firm-training participation accurately (see Black et al. (2023) for an in-depth discussion of measurement issues).

Given the diverse ways in which firm training is organized, it is important to clearly define the concept before eliciting specific beliefs. We therefore provided respondents with the following standardized definition. *Firm training refers to courses or events offered by your company to refresh existing professional skills or learn new ones. These are fully or partially financed by your company and can occur during or outside working hours. Firm training can be provided both externally and internally, ranging from a few hours to several months in duration.* This definition extends the AES definition by including information on training duration and provider type, reflecting the stylized facts presented in Section 2.2, and is more detailed than definitions used in other surveys like the AES, PIAAC or SOEP.

Realized Firm Training. We ask respondents whether they participated in any firm training over the last 12 months. Our question format follows established surveys such as

the AES and PIAAC. The exact question wording is provided in Appendix D.1.

Firm Training Intentions. To measure firm training intentions, we use the self-reported probability (0–100%) of participating in at least one week (40 hours) of firm training over the next year. This duration reflects a realistic training scope, as the average realized training time among respondents who participated in training is 38 hours. Eliciting choice probabilities, rather than relying on binary responses or Likert scales, offers several advantages: it captures individual uncertainty, allows for interpersonal comparison, and conveys richer information (Manski 2004; Blass et al. 2010).

Table 2 presents actual and intended firm training participation in our sample. 56% of workers participated in firm training in the last 12 months. At the intensive margin, among those who participated, the average training duration was 38 hours, with a median of 16 hours. Nearly all training was employer-financed (98%) and conducted during working hours (96%). Regarding intended future participation, respondents report an average probability of 32% to engage in firm training in the next year. This lower figure compared to realized firm training likely reflects the higher duration threshold used in the intention measure, which specifies a minimum of 40 hours of training.

TABLE 2. Realized and intended firm training participation

	Mean (1)	Std. Dev. (2)
Participated in the last 12 months	55.53	49.70
Conditional on participation		
Hours in training	37.92	157.97
Training financed by employer	0.98	0.15
Training during working hours	0.96	0.19
Probability to participate in the next 12 months	31.57	32.62

Notes: N = 3,701; conditional on participation: N=2,055. Columns (1) and (2) report means and standard deviations. "Training financed by employer" equals 1 if financed at least partly by the employer, 0 otherwise; "Training during working hours" equals 1 if taking place at least partly during working hours, 0 otherwise.

Different pieces of evidence support the validity of our firm training measures. First, realized and intended firm training participation in our sample follows patterns consistent with the Adult Education Survey (AES): younger, more educated workers and those in larger firms are more likely to participate, both retrospectively and prospectively (see Table 3).[15] Conversely, participation rates are lower among female workers, and those with fewer working hours (e.g., Backes-Gellner et al. 2014). Second, validating our measure of intended future training participation, we find that workers who participated in firm training in the past 12 months are 26 percentage points more likely to expect participating in the next year compared to those who did not. The correlation between intended and realized participation is 0.4. Given the path dependency of workers' training activities (see Pischke

[15]Appendix Table A.3 presents actual and intended firm training participation of higher- and lower-skilled workers.

2001), this correlation suggests that our expectations measure effectively captures future training participation. When presenting our results, we provide two further validations of our training measures. We show that (i) beliefs predict both realized and intended training participation (see Section 4), and (ii) our findings are robust to adjusting for reliability of responses (see Section 5).

TABLE 3. Predictives of realized and intended firm training participation

	Realized firm training		Intended firm training	
	(1) Bivariate	(2) Multivariate	(3) Bivariate	(4) Multivariate
Age	-0.006***	-0.004***	-0.006***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Female	-0.079***	-0.038**	-0.072***	-0.043***
	(0.016)	(0.017)	(0.011)	(0.011)
Higher-skilled	0.216***	0.189***	0.124***	0.096***
	(0.016)	(0.016)	(0.011)	(0.011)
Weekly hours <35	-0.066***	-0.012	-0.085***	-0.048***
	(0.020)	(0.021)	(0.012)	(0.013)
Above median number of workers at firm	0.151***	0.131***	0.075***	0.058***
	(0.016)	(0.016)	(0.011)	(0.010)
Obervations		3701		3701
R^2		0.07		0.07

Notes: Columns (1) and (3) report coefficients from separate bivariate OLS regressions; columns (2) and (4) report multivariate OLS regression results. Dependent variables: "Realized firm training" equals 1 if firm training participation occurred in the last 12 months, 0 otherwise; "Intended firm training" is the probability to participate in the next 12 months (0–1). Robust standard errors clustered at the individual level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

3.3 Eliciting Workers' Beliefs

To elicit workers' beliefs about the (non-)pecuniary returns to training, we present each respondent with two hypothetical scenarios: one in which they participate in training lasting two weeks (80 hours) each calender year until retirement, and one in which they do not participate in any training. For both scenarios, we ask them to imagine their professional lives in 2030 – six years after the survey. This approach – now standard in the literature on economic expectations (e.g., Dominitz and Manski 1996; Arcidiacono et al. 2020; Wiswall and Zafar 2021) – allows us to capture respondents' conditional expectations about future career outcomes under both scenarios. Moreover, it enables us to measure expectations about important non-pecuniary outcomes – such as job task complexity and enjoyment, or workplace stress – that are rarely available in administrative data. By focusing on within-individual variation in expectations, any differences between the two scenarios can be interpreted as the perceived impact of firm training.[16]

[16] In Section 5 we discuss the potential relevance of experimenter-demand effects in our design.

When designing the two scenarios, we made several deliberate choices to ensure they are both realistic and informative. First, we set the firm training duration at two weeks per year – twice the average annual training reported in our sample – to create a credible yet substantial contrast between scenarios. Second, we opted for a six-year time horizon when eliciting expectations to allow sufficient time for training returns to materialize.[17] Third, our scenarios contrast annual firm training with no training at all – both realistic scenarios given the path dependency in training participation (e.g., Pischke 2001).

We elicit workers' beliefs about expected earnings and seven non-pecuniary career outcomes: whether they will have professional success, take on more complex job tasks, enjoy their job tasks, experience workplace stress, get promoted, quit their job, or be laid off. Figure 1 provides an overview of the belief elicitation task. We measure earnings beliefs in terms of gross monthly earnings, and ask respondents to report their beliefs about whether non-pecuniary outcomes materialize as probabilities (0-100%). For each outcome, respondents report two values – one for the scenario with firm training and one without.

To provide a more comprehensive picture of return beliefs and how they relate to training participation, we go beyond expected earnings returns and also elicit a broader set of non-pecuniary return dimensions. While expected earnings returns likely play a role in training decisions, workers may also care about factors such as job stability, career progression, or workplace stress. As Wiswall and Zafar (2021) highlight in the context of tertiary education, neglecting non-pecuniary return beliefs can lead to upward-biased estimates of how earnings expectations affect college major choice. Similarly, understanding the perceived costs and benefits of firm training requires measuring beliefs across multiple career outcomes. For many of the return dimensions, the sign of the expected returns is theoretically ambiguous (e.g., whether training increases or decreases workplace stress), and their relationship to actual and intended training participation is unclear a priori. Our survey is designed to address these empirical questions. In the following, we discuss the specific belief dimensions we consider in more detail.

[17] This duration falls within the typical time range used in labor or education economics research, where time horizons vary from weeks to decades depending on context (e.g., Wiswall and Zafar 2021; Mueller and Spinnewijn 2023).

FIGURE 1. Belief elicitation task

	Scenarios	
Expected outcomes in 2030	With firm training	Without firm training
Gross monthly earnings (in €)	...	...
Probability (0–100%) to ...		
... have professional success	...	...
... have more complex tasks than today	...	...
... enjoy tasks at work	...	...
... experience work-related stress	...	...
... get promoted at least once	...	...
... quit current job	...	...
... be laid off	...	...

Notes: This figure depicts the belief elicitation task in our survey. For screenshots of the exact version implemented in the survey, see Appendix D.2.

3.3.1 Pecuniary Returns: Earnings Beliefs

To investigate perceived earnings returns to firm training, we elicit respondents' expected gross monthly earnings for the two hypothetical training scenarios. Respondents are instructed to assume that they will work the same number of hours as in their current job. This eliminates potential distortions in earnings expectations caused by expected labor supply changes over the next six years, including any such differences between the scenario with and without firm training. Additionally, respondents are told to disregard inflation, ensuring that expected earnings are not influenced by inflation expectations.

For our analysis, we convert these earnings expectations into full-time equivalents and winsorize the data at two thresholds: from below at the current full-time monthly gross minimum wage (2,135 €), and from above at the 98th percentile of the population wage distribution in Germany (14,583 €).[18] We analyze both the absolute difference in expected earnings between the two scenarios, and the relative increase from the no-training to the training scenario. Focusing on relative differences has the advantage of accounting for baseline wage disparities – for example, between higher- and lower-skilled workers.

3.3.2 Beliefs about Non-Pecuniary Returns

In addition to earnings expectations, we elicit expectations about seven further career outcomes in 2030. These include one general outcome capturing whether workers expect to have a successful professional life, three job characteristics (i.e., taking on more complex tasks, enjoying tasks, and experiencing workplace stress), and three broader career outcomes

[18]This adjustment affects 8% of the sample, with 5% of observations winsorized at the lower bound and 3% at the upper bound.

(i.e., getting promoted, quiting job, or being laid off).[19] For each of these seven items, respondents report the probability (0–100%) that the outcome will occur under both training scenarios.

The first outcome is a general question asking respondents to report the probability that they will have a successful professional life. This item serves as a catch-all measure to capture the overall expected effect of firm training on workers' careers. The remaining sets of items are designed to break down this overall expectation into more specific beliefs about job characteristics and career outcomes.

The second set of outcomes captures beliefs about non-wage job characteristics by eliciting the expected probabilities of experiencing complex job tasks, enjoying tasks, and encountering work-related stress. The nature of job tasks is a central determinant of labor market trajectories, with more complex tasks often linked to faster earnings growth (e.g., Acemoglu and Autor 2011; Deming 2024). Enjoyment of tasks also plays an important role, given strong associations between job satisfaction and productivity, retention, and absenteeism (Oswald et al. 2015; Böckerman and Ilmakunnas 2009; Krekel et al. 2019). Conversely, high levels of work-related stress can impair both physical and mental health, while also being associated with increased productivity (e.g., Nagler et al. 2023). A priori, it is unclear whether firm training improves or worsens the amenity value of job tasks – making the direction of its effects on (expected) job characteristics an empirical question. On the one hand, training may enhance job quality by equipping workers to take on more meaningful or satisfying tasks. On the other hand, it may also increase pressure and responsibility if newly acquired skills lead to more complex roles that some workers find overwhelming. For instance, Battisti et al. (2023) show that training yields routine-task workers to transition into more abstract jobs. Despite this, little is known about how workers themselves perceive changes in job characteristics resulting from firm training.

The third set of outcomes focuses on key career events typically examined in the labor-economics literature: the likelihood of receiving a promotion, quitting one's job, and being laid off. Promotions are widely recognized as key driver of earnings growth over the life cycle (Baker et al. 1994; Gibbons and Waldman 1999; Bronson and Thoursie 2019; Bayer and Kuhn 2025). If firm training enhances worker productivity – as documented in studies like Dearden et al. (2006) and Konings and Vanormelingen (2015) – then trained workers should be more likely to advance within their current firm (Benson et al. 2019). Since much of firm training builds general skills, training may also increase workers' promotion prospects at other employers. Workers' perceived probability of quitting captures their beliefs about outside options (e.g., Stigler 1961; Nelissen et al. 2017; Hoffman and Burks 2017; Jäger et al. 2024). Workers might expect that, despite training making them more productive, the associated wage increase within their firm may not fully reflect their higher productivity – especially in firms with compressed wage structures (Pfeifer 2016). Workers may also believe

[19] We refer to these measures as non-pecuniary return beliefs to distinguish them from earnings expectations. However, we acknowledge that this distinction is not always clear-cut – for instance, promotions often coincide with changes in earnings.

that other firms pay differently even for similar roles, and that firm training could improve their chances of securing a better-paying job elsewhere (Caldwell et al. 2025). Jobloss, on the other hand, can result in substantial and persistent earnings losses for workers (Jacobson et al. 1993; Braxton and Taska 2023; Gulyas and Pytka 2025). Firm training may help mitigate this risk – for example, by enabling workers to transition away from tasks that are at risk of automation and toward more abstract, resilient job roles (Battisti et al. 2023).

3.4 Information-Provision Experiment

While the research interest of this paper is primarily descriptive – documenting the distribution of worker beliefs about firm training and their relationship to (intended) firm training participation – we also explore the extent to which addressing workers' beliefs causally affect intended future training participation. To this end, we implement a simple information-provision experiment (Haaland et al. 2023) at the end of the survey. Importantly, the goal of this experiment is not to precisely pin down how each belief dimension affects training participation. Rather, it serves as a proof-of-concept to examine whether a generic information treatment that targets worker beliefs can affect training intentions.

The core of the experiment is a randomized information treatment targeting two key barriers to training participation identified in the literature: (1) workers' uncertainty about the returns to firm training, and (2) workers' beliefs that they are no longer accustomed to learning (Osiander and Stephan 2018).[20] Below, we describe the key design elements of the experiment. Appendix D.3 provides the exact question wording.

Prior beliefs. First, we elicit respondents' prior beliefs about those two barriers. In particular, we elicit respondents' agreement with the following six statements: (i) firm training increases their salary in the long term, (ii) it improves their long-term career opportunities, (iii) they can improve at their job through practice, (iv) innate ability matters more than effort, (v) they would find it easy to learn new things in training, and (vi) being out of the habit of learning is a barrier to training participation. In our analysis, we summarize items (i) and (ii) into a "positive return beliefs" index, and (iii) to (vi) into a "positive learning beliefs" index.

Randomized information provision. Subsequently, respondents in the treatment group are informed that research shows firm training increases wages and improves career opportunities. In addition, drawing on insights from positive mindset interventions (Yeager and Dweck 2020), they are told that anyone can learn new things through practice. Control group respondents do not receive any information.

Outcome: Probability of accepting a training offer. After the treatment, we elicit our outcomes of interest. Specifically, we ask respondents to imagine that their employer offers them the opportunity to participate in 80 hours of firm training during working hours. We then ask them to report the probability (0-100%) of accepting the offer in two different

[20]The experiment was preregistered in the AEA RCT Registry (AEARCTR-0013319).

scenarios: (1) if the employer covers the full cost, and (2) if they must contribute 20% of their current net monthly wage to finance training costs. Varying the level of personal training costs helps mitigate potential ceiling effects. Unlike the earlier question eliciting training expectations, we now hold the supply of training (i.e., the employer's offer) fixed. This framing allows us to isolate respondents' willingness to accept a concrete training opportunity. We intentionally designed the question differently from the other questions on training intentions to minimize the risk of consistency bias (Falk and Zimmermann 2017).

4 Results

We present our empirical results in four steps. Section 4.1 documents beliefs about both pecuniary and non-pecuniary returns to firm training for the overall sample. Section 4.2 examines the extent to which these beliefs predict intended and realized training participation. Section 4.3 analyzes how return beliefs vary by skill level. Finally, Section 4.4 presents the results of our information-provision experiment.

4.1 Beliefs about Returns to Firm Training

We begin by analyzing workers' beliefs about pecuniary returns – that is, expected wage differences with and without firm training (Section 4.1.1), and then turn to beliefs about non-pecuniary returns (Section 4.1.2).

4.1.1 Beliefs about Pecuniary Returns

On average, workers expect gross monthly earnings of 5,481 € in 2030 in the scenario with firm training, compared to 5,140 € without training (see column 1 of Table 4). The absolute difference of 341 € corresponds to an expected relative earnings return of 8.62%. These perceived returns are substantial, roughly aligning with empirical estimates of the returns to one additional year of full-time schooling (e.g., Hanushek et al. 2015).[21] Median expectations are considerably lower: respondents expect median monthly earnings of 4,686 € with training and 4,375 € without, implying a median expected return of 2.04%. This pattern suggests that (i) the average expected returns reported in column 1 of Table 4 are largely driven by workers with relatively high earnings expectations, and (ii) earnings beliefs are fairly dispersed. This dispersion is also reflected in the fact that only about half of our sample (52%) expects any positive return (i.e., higher earnings with training than without), 46% expect zero returns, and 3% expect negative returns.

[21] While sizable, expected earnings returns to firm training are somewhat smaller than those documented in other educational domains. For example, Wiswall and Zafar (2021) find that female students expect a 30% earnings increase at age 23 from completing a science or business degree instead of a humanities degree. Boneva et al. (2022) report that undergraduate students in England expect a 15% earnings premium at age 35 from completing a postgraduate degree compared to holding only an undergraduate degree. However, the educational settings in these scenarios differ fundamentally from the firm training context we study, making return beliefs difficult to compare directly.

While actual returns to training provide an objective benchmark, it is individuals' subjective return beliefs that should ultimately determine their training decisions. Next, we compare these beliefs to empirical return estimates to assess how well expectations align with realized outcomes. Using German PIAAC data, Guo et al. (2024) find that participation in job training leads to sizeable wage gains. In their preferred specification, they estimate average earnings returns of 12.6% for participating in training in the previous year.[22] Thus, workers' beliefs are, on average, reasonably well calibrated.

Expected returns to training likely depend on the specific content of the training and the labor-market-relevant skills it imparts. Next, we therefore differentiate between specific training contents. To this end, we asked respondents for which types of skills their employer provides training opportunities: (1) soft skills and personal development, (2) IT skills, (3) office and administrative skills, and (4) technical, practical, or job-specific skills.[23] Figure A.1 presents average relative expected return beliefs, separately for respondents with access to different types of training. We find that all training categories are associated with substantial expected earnings returns, with IT skills showing somewhat higher perceived returns than the others. This suggests that the documented positive average expected earnings returns are not driven by outliers or niche training types, but rather reflect broadly shared perceptions across various types of skill training.

4.1.2 Beliefs about Non-Pecuniary Returns

Figure 2 presents average expectations about non-pecuniary career outcomes in 2030 under the scenario with firm training (blue bars) and without firm training (red bars), along with the difference between them (indicated above the bars). On average, respondents expect a higher likelihood of professional success with firm training (59.9%) than without it (52.5%), corresponding to an expected return of over 7 percentage points. Thus, workers perceive firm training as overall beneficial for their professional life – an assessment consistent with prior evidence on the benefits of training programs (Black et al. 2023).

[22] Potential reasons why the estimates differ are manifold. One is that the definition of firm training used in PIAAC differs slightly from the one used in this paper. In particular, the PIAAC definition includes both firm training and self-initiated job-related training undertaken without any employer support.

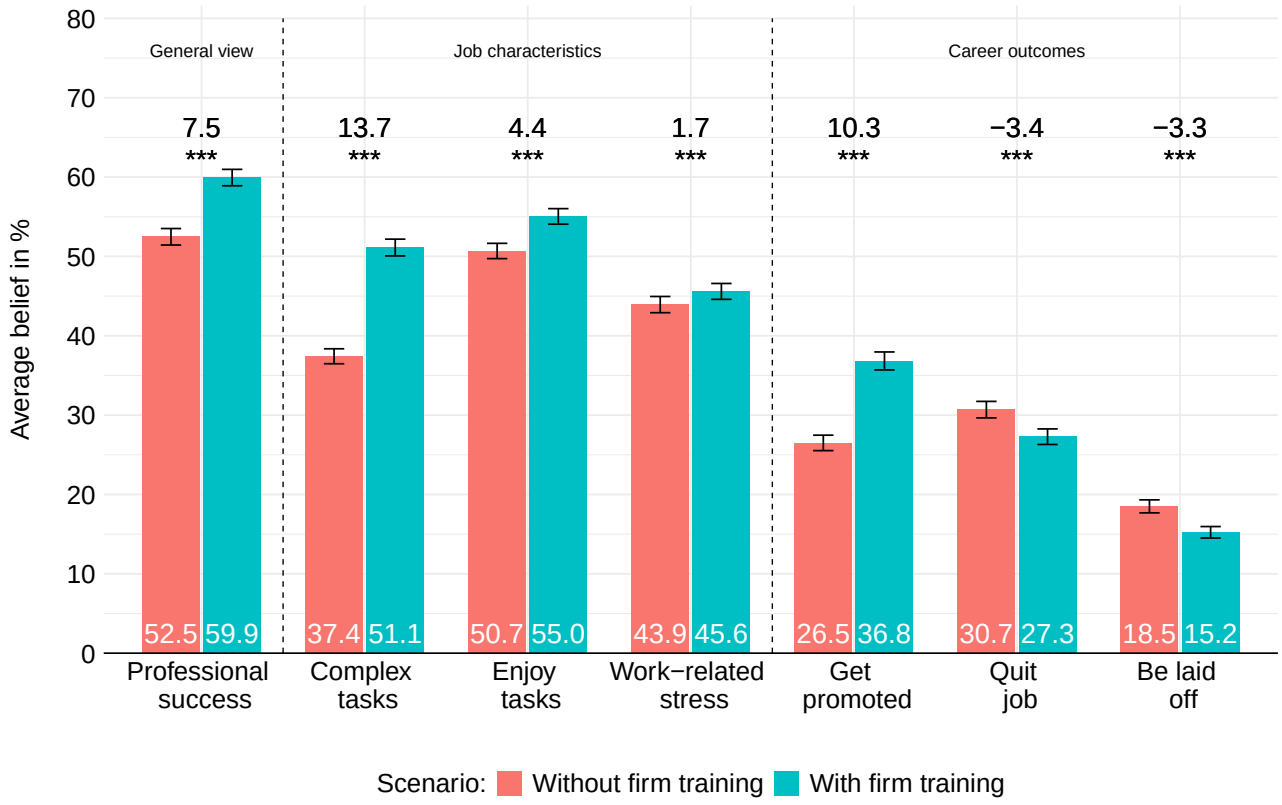
[23] The exact wording of this multiple choice question was as follows: "For which types of skills does your employer offer you the opportunity to learn or improve them through firm training?" In addition to the answer categories mentioned above, respondents could also select "none" and "other". 22% of respondents selected "none", 30% selected one option, and 47% selected two to four options. As a result, 22% of respondents are not represented in the figure, while 47% appear in multiple categories.

TABLE 4. Earnings expectations descriptives

	Mean (1)	Std. Dev. (2)	Median (3)
Expected earnings in €			
With firm training	5481	2987	4686
Without firm training	5140	2898	4375
Individual expected returns			
Absolute	341	867	100
Relative in %	8.62	29.43	2.04
Share positive	0.51	0.50	1

Notes: N = 3,701. Mean, standard deviation, and median are summary statistics of worker- reported expectations of monthly gross earnings. Individual expected returns contain summary statistics of workers' perceived absolute and relative returns. Relative returns correspond to the within-worker difference in expected earnings across scenarios divided by earnings in the scenario without firm training. All figures are in full-time equivalents. Earnings expectations are winsorized from below at the minimum wage (2,135 €) and from above at the 98th percentile of the German wage distribution (14,583 €).

FIGURE 2. Beliefs about non-pecuniary returns



Notes: N = 3,701. This figure displays average probabilities for each event under two scenarios: with and without firm training. Bars show means and 95% confidence intervals. The number above each pair of bars indicates the mean difference between the two scenarios and stars denote significance levels from paired t-tests. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

When analyzing the perceived effect of firm training on expected job characteristics, workers anticipate a 13.7 percentage points higher likelihood of performing more complex tasks in the scenario with firm training (51.1%) compared to the scenario without (37.5%).[24] The expected probability that workers will enjoy their job tasks is also higher with firm training (55.0%) than without (50.7%), implying a modest positive difference of 4.4 percentage points.

In contrast, work-related stress is expected to remain largely unchanged across scenarios: respondents report a 45.6% likelihood to encounter work-related stress with training and 43.9% without, a small difference of 1.7 percentage points. Thus, workers do not seem to perceive firm training to substantially increase stress levels – alleviating concerns that more complex tasks might come at the cost of higher psychological strain.

In terms of broader career outcomes, workers expect a higher likelihood of getting promoted in the scenario with firm training (36.8%), compared to the scenario without (26.5%), implying a substantial positive expected return of 10.3 percentage points. The expected likelihood of quitting is 3.4 percentage points lower with firm training (27.3%) than without (30.7%), and the expected risk of being laid off decreases by 3.3 percentage points with firm training (15.2% versus 18.5%).

Appendix Figure A.1 displays these non-pecuniary return beliefs broken down by the type of training content respondents have access to. As with pecuniary return beliefs, we find no pronounced differences across training types. The signs of the expected effects are consistent, and the magnitudes are broadly similar across all skill categories. This suggests that perceived non-pecuniary returns to firm training are largely universal, regardless of training content.

In summary, workers perceive that firm training positively affects not only their earnings, but also key non-pecuniary career outcomes, especially promotion opportunities and job-task complexity. Importantly, these effects are not expected to come at the cost of increased stress, implying an overall positive perception of firm training. These findings highlight that (non-)pecuniary return beliefs may play an important role in shaping training decisions, which we study in the next section.

4.2 Return Beliefs Predict Intended and Realized Training Participation

Having documented that workers expect substantial (non-)pecuniary returns to firm training, we next investigate how these expectations relate to intended and realized firm training participation.

We begin by analyzing intended future training participation. Specifically, we estimate worker-level regressions in which the dependent variable is the self-reported probability of participating in at least one week (40 hours) of firm training in the next year. The

[24] The fact that a substantial share also expects more complex tasks without firm training aligns with, for example, Werner et al. (2022), who show that a plurality of German citizens expect job tasks to become more demanding in the future.

key independent variables are workers' return beliefs – measured as the percentage point differences in expected (non-)pecuniary returns between the scenario with and without firm training.

Figure 3 shows that several dimensions of return beliefs are significantly associated with intended firm training participation. In particular, expected returns regarding earnings, professional success, task complexity, task enjoyment, and promotion prospects show positive and significant coefficients. Conversely, expected differences in the likelihood of quitting one's job or being laid off across training scenarios are negatively related to training intentions. By contrast, expected effects of training on work-related stress are not significantly associated with training intentions. The magnitude of the regression coefficients varies notably across belief domains. Without additional controls, a one percentage point increase in expected earnings returns is associated with a 0.1 percentage point increase in intended training participation (see pink coefficients). In contrast, non-pecuniary return beliefs – such as those about professional success and task enjoyment – show substantially larger coefficients (of 0.2 percentage points each). This pattern suggests that non-pecuniary return beliefs are particularly strong predictors of training intentions, underscoring the importance of considering a broader set of expected returns beyond earnings alone.

These general patterns remain robust when we control for a rich set of worker, firm, and past training characteristics, as well as economic-sector fixed effects (see brown coefficients). While the coefficients naturally attenuate, all previously significant associations remain statistically significant after conditioning on these variables.

A common criticism against self-reported intentions is that they may not always translate into actual behavior. This concern also applies to our measure of intended future training participation. To address this, we complement our analysis by examining how workers' return beliefs relate to realized training behavior. Using the same regression model as before, Appendix Figure A.2 presents results with the dependent variable indicating whether a respondent participated in any firm training in the past 12 months. The overall pattern closely mirrors that for intended training: without controls, both earnings and – especially – non-pecuniary return beliefs, such as those about professional success and task enjoyment, strongly predict realized training participation. While effect sizes are somewhat attenuated with controls, the general pattern remains intact.[25]

In sum, our analysis shows that workers' beliefs about the returns to firm training are strong predictors of actual and intended training participation, with beliefs about non-pecuniary career outcomes playing an especially important role.

[25]Naturally, explaining past training participation with current return beliefs, as we do, has its own limitations. Most notably, beliefs may evolve in response to past training experience, leading to potential reverse causality. While we do not claim a causal interpretation of our findings, it is reassuring that results are highly consistent for both intended and realized training, reinforcing the link between return beliefs and training behavior.

FIGURE 3. Do return beliefs predict intended firm training participation?

Notes: N = 3,701. The probability to participate in firm training next year (0-100) is regressed on on the expected earnings return in % in the leftmost column and on the difference in values between the two hypothetical scenarios in percentage points for the remaining non-pecuniary belief dimensions. "None" indicates point estimates from a bivariate regression, while "Worker, firm, and detailed training characteristics + sector FE" indicates point estimates upon including these controls. Worker and firm characteristics: workers' age, gender, risk aversion, patience, locus of control, and current full-time equivalent earnings, as well as dummies indicating part-time work and above median firm size. Detailed training characteristics: indicators for the absence of training opportunities at the current workplace, whether workers were denied training previously, whether workers think their job is more demanding than a few years ago, and whether it is possible to accumulate skills through learning-by-doing. Fixed effects for five sectors are included.

4.3 Belief Gaps Between Lower- and Higher-Skilled Workers

Motivated by evidence that lower-skilled workers have lower levels of both actual and intended participation in firm training (e.g., Bassanini et al. 2007; Fouarge et al. 2013; Lergetporer et al. 2023), we now turn to differences in return beliefs by skill level. We first document differences in pecuniary and non-pecuniary return beliefs between higher- and lower-skilled workers (Sections 4.3.1 and 4.3.2). Then, we assess for how much of the skill gap in intended training participation these beliefs can account (Section 4.3.3).

4.3.1 Beliefs about Pecuniary Returns by Workers' Skill Level

Table 5 reports expected gross monthly earnings with and without firm training, along with the resulting (relative) return beliefs, separately for lower- and higher-skilled workers.

On average, lower-skilled workers expect substantially lower earnings than higher-skilled workers – both in the training scenario (4,571 € vs. 6,543 €) and without training (4,275 € vs. 6,151 €). This pattern broadly reflects known empirical earnings gaps (see Appendix Table A.2). While absolute expected returns to firm training are somewhat lower for lower-skilled workers (297 € vs. 392 €), relative expected returns are nearly identical across both groups (8.45% vs. 8.82%). Interestingly, a slightly higher share of lower-skilled workers (54%) expect positive earnings returns compared to higher-skilled workers (49%). Overall, these patterns suggests that beliefs about the (relative) pecuniary returns to firm training are quite similar across skill groups. According to PIAAC data, the average empirical earnings return to firm training is 12.6%, with no significant heterogeneity between lower- and higher-skilled workers.[26] Thus, neither skill group holds major misperceptions about the pecuniary returns to firm training.

TABLE 5. Earnings expectations by workers' skill-level

	Higher-skilled		Lower-skilled		Difference
	Mean	Std. Dev.	Mean	Std. Dev.	Lower − Higher
	(1)	(2)	(3)	(4)	(5)
Expected earnings in €					
With firm training	6,543	3,353	4,571	2,268	-1,971***
Without firm training	6,151	3,297	4,275	2,158	-1,876***
Individual expected returns					
Absolute	392	949	297	788	-95***
Relative in %	8.82	30.71	8.45	28.29	-0.37
Share positive	0.48	0.50	0.53	0.50	0.05***
Observations		1993		1708	3701

Notes: Means and standard deviations are summary statistics of worker-reported expectations of monthly gross earnings by workers' skill-level. Individual expected returns contain summary statistics of workers' perceived absolute and relative re-turns. Relative returns correspond to the within-worker difference in expected earnings across scenarios divided by earnings in the scenario without firm training. All figures are in full-time equivalents. Column (5) is the mean difference. Earnings expectations are winsorized from below at the minimum wage (2,135 €) and from above at the 98th percentile of the German wage distribution (14,583 €). Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.3.2 Beliefs about Non-Pecuniary Returns by Workers' Skill Level

We now turn to differences in beliefs about non-pecuniary returns to firm training across skill groups. Figure 4 depicts return beliefs of lower-skilled (green bars) and higher-skilled workers (orange bars). As in Section 4.2, we define beliefs about non-pecuniary returns as

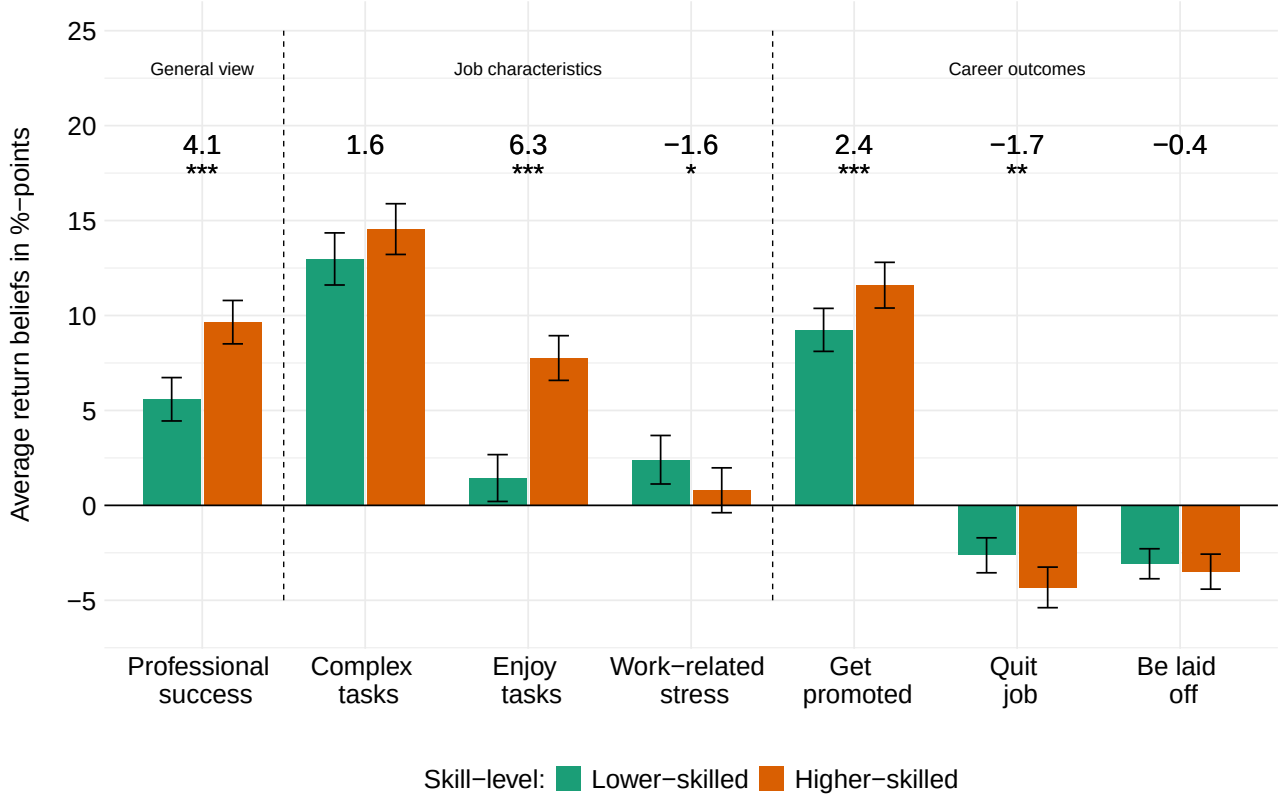
[26]We thank Yuchen Guo for calculating these figures using the German data and applying our sample restrictions and classification of higher- and lower-skilled workers.

the difference in the stated likelihood that a given career outcome will occur in 2030 between the scenarios with and without firm training.

The general pattern across these career outcomes is that higher-skilled workers consistently perceive firm training as having more positive effects. On average, they expect training to increase their likelihood of professional success by nearly 10 percentage points, compared to only 5.6 percentage points among lower-skilled workers. Regarding job characteristics, the expected impact of firm training on task complexity and work-related stress is relatively similar across skill groups. However, notable differences emerge in beliefs about task enjoyment, with higher-skilled workers expecting substantially larger gains from training (7.8 percentage points) than lower-skilled workers (1.4 percentage points). More positive expectations among higher-skilled workers also extend to broader career outcomes. They anticipate a larger positive effect of training on their promotion prospects and a stronger negative effect on the likelihood of quitting their job. In contrast, expectations regarding the impact of training on the probability of being laid off are similar across skill groups.

In sum, these findings indicate that higher-skilled workers expect greater returns to firm training – particularly in the non-pecuniary domain – which may help explain their higher participation rates.

FIGURE 4. Difference in return beliefs by workers' skill-level



Notes: N = 3,701. This figure displays average belief gaps between lower- and higher-skilled individuals for each event. Bars show group means with 95% confidence intervals. The number above each pair of bars indicates the mean difference between groups and stars denote significance levels from independent t-tests. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.3.3 Can Beliefs Explain Skill Gaps in Firm Training Participation?

In the previous sections, we have documented that higher-skilled workers hold more optimistic beliefs about the returns to firm training than lower-skilled workers. We now ask to what extent these belief gaps help explain the observed skill gap in (intended) training participation.

Table 6 regresses intended firm training participation on a higher-skilled dummy. Column 1 shows that higher-skilled workers are 12.4 percentage points more likely to intend participating in training next year. Controlling for return beliefs reduces this gap to 10.9 percentage points (column 2), implying that beliefs explain roughly 12% of the skill gap. A similar pattern holds when controlling for a rich set of worker, firm and training characteristics and occupation fixed effects: with these covariates, the skill gap reduces to 3.5 percentage points (column 3). Additionally accounting for worker beliefs reduces the gap to 3.2 percentage points, implying a reduction of about 10%.[27]

[27]The pattern is similar for realized training behavior over the past year, though the share explained by beliefs is somewhat smaller (see Appendix Table A.4).

Thus, accounting for beliefs explains a meaningful share of the skill gap in training intentions. Naturally, this descriptive analysis does not speak to whether beliefs are a *causal* determinant of the gap. To add causal structure to this relationship, the next section presents results from our information-provision experiment.

TABLE 6. Skill gap in firm training intentions

Dep. Var.: Training Intentions	(1)	(2)	(3)	(4)
Higher-skilled	12.396***	10.897***	3.516***	3.166***
	(1.056)	(1.043)	(1.064)	(1.057)
Beliefs		✓		✓
Worker and firm char.			✓	✓
Training char.			✓	✓
Sector			✓	✓
R^2	0.036	0.079	0.214	0.233

Notes: N = 3,701. OLS coefficient estimates of a dummy indicating whether a worker is higher skilled in a regression of the probability of participating in firm training next year on varying sets of controls. Beliefs: belief gaps in pecuniary and non-pecuniary dimensions. Worker and firm char.: workers' age, gender, risk aversion, patience, locus of control, and current full-time equivalent earnings, as well as dummies indicating part-time work and above median firm size. Training char.: indicators for the absence of training opportunities at the current workplace, whether workers were denied training previously, whether workers think their job is more demanding than a few years ago, and whether it is possible to accumulate skills through learning-by-doing. Sector: Fixed effects for five sectors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.4 Experimental Results

This section presents the results from our information-provision experiment, which serves as a proof-of-concept to test whether addressing worker beliefs can causally reduce the skill gap in training intentions. The balancing tests in Appendix Table A.5 confirm that the random assignment of treatment and control groups worked as intended: only two out of twelve pairwise comparisons of worker characteristics between experimental groups yield marginally significant differences ($p < 0.1$), as would be approximately expected by pure chance.

Table 7 presents the main experimental results. It shows the effects of the information treatment — which informed respondents that firm training improves wages and career opportunities and that anyone can learn new things through practice — on respondents' reported probability of accepting a firm training offer. Columns 1 and 2 display results for a scenario in which the employer covers the full cost of training, while columns 3 and 4 refer to a scenario in which workers contribute 20% of their current net monthly salary. Odd-numbered columns report average treatment effects, and even-numbered columns show heterogeneous treatment effects by skill level.

Descriptively, the average intention to participate in firm training in the control group is 81% when training is free of charge and drops to 31% when workers are required to contribute to the costs (see control means). The substantial gap between training intentions in the two scenarios highlights the critical role of personal costs in shaping training decisions. Moreover, in line with earlier results, higher-skilled individuals consistently report greater intentions to participate in training across both scenarios.

The information treatment increases workers' average willingness to participate in firm training by 2.2 percentage points when training is free, and by 2.1 percentage points when workers are required to contribute to the costs. Notably, the effects are concentrated among lower-skilled workers, who show significant treatment effects of 3.0 and 2.8 percentage points in the two scenarios, respectively. In contrast, effects for higher-skilled workers are smaller and not statistically significant. Lower-skilled workers, who hold more pessimistic beliefs about the returns to firm training, are more responsive to an intervention that addresses related beliefs. This greater responsiveness helps narrow the skill gap in training intentions.

TABLE 7. Information treatment effects on training intentions

	Probability of accepting a training offer			
	.. with no costs		**.. with costs**	
	(1)	(2)	(3)	(4)
Treatment	2.234**	3.034**	2.138**	2.847**
	(0.896)	(1.306)	(1.017)	(1.354)
Treatment x Higher-skilled		-1.667		-1.388
		(1.789)		(2.038)
Higher-skilled		3.581***		6.843***
		(1.306)		(1.495)
Treatment effect on higher-skilled		1.367		1.459
		(1.212)		(1.523)
Control mean	81.03	81.03	30.70	30.70
Observations	3701	3701	3701	3701
Controls	✓	✓	✓	✓

Notes: OLS regressions. Dependent variables: "Probability of accepting a training with no costs" refers to an offer of 80 hours of training fully financed by the employer. In the scenarios "with costs," workers are required to contribute 20% of their current net monthly salary. Significance of treatment effect on higher-skilled respondents are calculated using post-estimation Wald tests. Control mean: mean of the outcome variable in the control group. Controls: age, dummies for female and ten occupational major groups (KldB 2010), risk preferences and patience. Robust standard errors clustered at the individual level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Next, we study heterogeneous treatment effects by prior beliefs. The information treatment targets two key barriers to firm training participation: pessimistic beliefs about expected returns and perceived learning barriers. Prior to the treatment, we elicited respondents' agreement with a set of statements related to both barriers, which we

summarize into two indices: "positive belief returns" and "positive learning returns" (see Section 3.4 for details; answers to the individual items are depicted in Appendix Table A.6). The heterogeneity analysis in Appendix Table A.7 shows that workers with more pessimistic views – both about training returns and learning barriers – respond more strongly to the information treatment than those with more optimistic beliefs. This suggests that information interventions hold particular promise for encouraging participation among workers who are most discouraged from training.[28]

5 Discussion and Conclusion

This paper investigates workers' beliefs about the returns to firm training using survey data from 3,701 respondents in Germany. We show that workers expect substantial returns – not only in terms of earnings, but also across a range of non-pecuniary career outcomes such as professional success, task enjoyment, and promotion prospects. These beliefs strongly predict both actual and intended participation in training. Lower-skilled workers expect lower non-pecuniary returns than their higher-skilled counterparts and are less likely to participate in training – a gap that is partly explained by differences in return beliefs. Moving beyond descriptive findings, we show experimentally that addressing such beliefs through information provision increases training intentions, particularly among lower-skilled workers.

While survey data like ours facilitate observing beliefs and expectations – which are usually not available in administrative or other data sources – they also come with limitations. First, for many belief dimensions, no objective benchmark exists to assess whether beliefs are accurate, which is important to consider when designing targeted information interventions. While we can compare earnings return beliefs to empirical estimates and find them generally well-calibrated, such validation is not possible for non-pecuniary beliefs due to the lack of objective benchmarks. That said, our primary interest lies in subjective beliefs, which ultimately shape behavior regardless of objective accuracy.

Second, one of our key outcomes is intended future behavior (i.e., training participation), which is sometimes criticized for uncertain predictive validity. Reassuringly, our findings on the role of return beliefs are robust when using realized rather than intended participation, suggesting that our results are not driven by the choice of outcome measure.

Third, our study is primarily descriptive, and while it establishes strong statistical associations between return beliefs and training behavior, it is not designed to fully disentangle underlying causal mechanisms. Our information-provision experiment provides first evidence that addressing beliefs can causally shift training intentions, especially among lower-skilled workers. However, it does not isolate the effects of specific belief dimensions – an important task for future research. Furthermore, it would be

[28] We also preregistered heterogeneity analyses by age. The information treatment significantly increases training intentions for older workers if training is for free and for younger workers if they have to contribute part of their wage (see Appendix Table A.8).

valuable to examine the external validity of our experimental findings in a field setting targeting actual – rather than intended – training participation.

Fourth, eliciting expectations under different scenarios within the same respondent (e.g., Dominitz and Manski 1996; Wiswall and Zafar 2021) raises potential concerns about experimenter-demand effects. Since differences across scenarios are salient by design, respondents may feel obliged to report responses they think align with the experimenter's expectations rather than their own views (de Quidt et al. 2018). While this is theoretically a concern, we consider it unlikely in our context: evidence suggests that demand effects are generally small in survey experiments (Mummolo and Peterson 2019), and the incentive to please an experimenter in an anonymous online setting is minimal. Overall, we believe the advantages of a within-subject design – in terms of statistical power and richness of individual-level data (List 2025) – outweigh the potential downsides stemming from stronger identification assumptions compared to between-subject designs.

Finally, a potential concern specific to survey data is that respondents may lack the self-knowledge required to accurately assess how firm training would affect their future outcomes. Even when respondents exert effort in answering, they may still face cognitive uncertainty – i.e., uncertainty about their own preferences (Enke and Graeber 2023; Dohmen and Jagelka 2024). This form of uncertainty can introduce residual measurement error that differs from inattentiveness or satisficing. It may lead some respondents to under- or overestimate returns to firm training, particularly in non-pecuniary dimensions that are inherently harder to verify, and thus distort their stated training intentions. While we cannot fully rule out this concern, we take a direct step to address it: Following Dohmen and Jagelka (2024), we elicited all respondents' self-reported answer reliability as a proxy for cognitive certainty.[29] In Appendix C, we replicate our main results for the subsample of respondents with reliable answers. Results remain virtually unchanged, suggesting that they are not driven by limited self-knowledge.

From a policy perspective, our findings suggest that beliefs about firm training play a critical role in shaping training participation. Leveraging these beliefs could be an effective strategy to promote upskilling – especially among lower-skilled workers – and may complement existing initiatives such as adult education vouchers (e.g., Schwerdt et al. 2012). Our experimental evidence shows that addressing belief-based barriers can causally increase training intentions in this group. Targeted information and encouragement campaigns could therefore be a promising tool for policymakers to engage more vulnerable workers in training programs – ultimately supporting their long-term labor market prospects.

[29]We follow Dohmen and Jagelka (2024) and use their general reliability item: "Please indicate on the scale below how reliable your answers to this survey are," measured on an 11-point Likert scale from 0 to 10. Respondents are classified as "reliable" if they select 9 or 10. In our sample, 80% fall into this category, compared to 70% in Dohmen and Jagelka's study.

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A Additional Figures and Tables

TABLE A.1. Representativeness

	Sample	Admin data	(1)-(2)
	(1)	(2)	(3)
Age groups			
25-34	28.42	32.76	-4.34
35-44	35.82	35.12	0.70
45-55	35.76	32.12	3.64
Gender			
Male	50.32	53.63	-3.31
Female	49.68	46.37	3.31
Federal state			
Baden-Wuerttemberg	12.99	14.07	-1.08
Bavaria	16.02	17.28	-1.26
Berlin	4.11	5.19	-1.08
Brandenburg	3.13	0.25	2.88
Bremen	0.76	0.10	0.66
Hamburg	2.24	0.33	1.91
Hesse	7.62	8.08	-0.46
Mecklenburg-Western Pomerania	1.76	0.16	1.60
Lower Saxony	10.08	8.86	1.22
North Rhine-Westphalia	20.85	20.92	-0.07
Rhineland-Palatinate	4.92	0.42	4.50
Saarland	1.22	0.11	1.11
Saxony	5.13	4.69	0.44
Saxony-Anhalt	2.76	0.22	2.54
Schleswig-Holstein	3.78	0.29	3.49
Thuringia	2.59	0.22	2.37
Occupational sector			
S1: Production of goods	17.50	24.87	-7.37
S2: Personal services	20.34	25.03	-4.69
S3: Business admin./business services	42.27	31.76	10.51
S4: IT-sector and the natural sciences	10.35	5.14	5.21
S5: Others in commercial services	10.35	12.73	-2.38
Skill level			
1: Unskilled tasks	4.00	15.79	-11.79
2: Skilled tasks	36.38	51.91	-15.53
3: Complex tasks	26.15	15.61	10.54
4: Highly complex tasks	30.17	16.24	13.93
Working time			
Fulltime	79.44	70.10	9.34
Parttime	20.56	29.90	-9.34

Notes: Column (1) shows participant characteristics of our final sample (N = 3,701) and the employment statistics from German Federal Employment Agency (BA 2024). Column (2) restricts the administrative data to employees aged 25–55, consistent with the age range of our sample. Column (3) reports differences between Column (1) and (2). Our sample was drawn to match official population statistics concerning age, gender, and federal state. Occupational sector and skill level are classifications derived from KldB 2010. We define parttime if weekly working hours are <35.

TABLE A.2. Respondent characteristics separately for higher- and lower-skilled

	(1) **All**	(2) **Higher-skilled**	(3) **Lower-skilled**	(4) **Difference**
Age	40.78	39.28	42.08	2.80***
Female	0.50	0.43	0.56	0.13***
Weekly hours	36.35	37.08	35.73	-1.35***
Weekly hours <35	0.21	0.17	0.24	0.07***
Higher-skilled	0.46	1.00	0.00	-1.00
Professional Degree				
Vocational degree	0.35	0.00	0.65	0.65***
Advanced vocational degree	0.16	0.18	0.14	-0.04***
University	0.45	0.80	0.14	-0.66***
None/other	0.04	0.01	0.06	0.05***
Number of workers at firm	452.95	479.95	429.81	-50.14***
Years at firm	10.78	9.99	11.45	1.45***
Gross monthly earnings	4669.84	5618.94	3862.75	-1756.20***
Observations	3701	1708	1993	3701

Notes: This table displays averages for the whole sample and by skill-level of the respondents. Column (4) gives the mean difference between the two groups and stars denote significance from t-tests comparing group means. Gross monthly earnings are converted to full-time equivalent earnings and winsorized from below at the minimum wage (2,135 €) and from above at the 98th percentile of the German wage distribution (14,583 €).

TABLE A.3. Firm training participation separately for higher- and lower-skilled

	(1) **All**	(2) **Higher-skilled**	(3) **Lower-skilled**	(4) **Difference**
Participated in the last 12 months	55.53	67.15	45.56	-21.60***
Conditional on participation				
Hours in training	37.92	45.19	28.74	-16.46*
Training financed by employer	0.98	0.98	0.97	-0.01
Training during working hours	0.96	0.98	0.94	-0.03***
Probability to participate in the next 12 months	31.57	38.25	25.85	-12.40***
Observations	3701	1708	1993	3701

Notes: Column (1) shows means for the whole sample column (2) and (3) shows means by skill-level of the respondents. Column (4) gives the mean difference between the two groups and stars denote significance from t-tests comparing group means. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

FIGURE A.1. Difference in return beliefs by workers' available skill training

Notes: This figure shows average belief gaps between individuals who have access to different types of skill training for each event. Respondents were asked: "For which types of skills does your employer offer you the opportunity to learn or improve them through firm training?" Answer options included: (1) soft skills and personal development, (2) IT skills, (3) office and administrative skills, (4) technical, practical, or job-specific skills, (5) none, and (6) other. Bars show group means with 95% confidence intervals. The number above each pair of bars indicates the mean difference between groups and stars denote significance levels from independent t-tests. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

FIGURE A.2. Do return beliefs predict realized firm training participation?

Notes: Coefficient estimates from a regression of binary firm training participation in the last 12 months on the expected earnings return in % in the leftmost column and on the difference in values between the two hypothetical scenarios in percentage points for the remaining non-pecuniary belief dimensions. "None" indicates point estimates from a bivariate regression, while "Worker, firm, and detailed training characteristics + sector FE" indicates point estimates upon including these controls. Worker and firm characteristics: workers' age, gender, risk aversion, patience, locus of control, and current full-time equivalent earnings, as well as dummies indicating part-time work and above median firm size. Detailed training characteristics: indicators for the absence of training opportunities at the current workplace, whether workers were denied training previously, whether workers think their job is more demanding than a few years ago, and whether it is possible to accumulate skills through learning-by-doing. Fixed effects for five sectors are included.

TABLE A.4. Skill gap in realized firm training

Dep. Var.: Training Intentions	(1)	(2)	(3)	(4)
Higher-skilled	21.595***	19.804***	9.937***	9.423***
	(1.600)	(1.600)	(1.586)	(1.590)
Beliefs		✓		✓
Worker and firm char.			✓	✓
Training char.			✓	✓
Sector			✓	✓
R^2	0.047	0.066	0.248	0.253

Notes: N = 3,701. Coefficient estimates of a dummy indicating whether a worker is higher skilled in a regression of a dummy for firm training participation in the past year (multiplied by 100) on varying sets of controls. Beliefs: belief gaps in pecuniary and non-pecuniary dimensions. Worker and firm char.: workers' age, gender, risk aversion, patience, locus of control, and current full-time equivalent earnings, as well as dummies indicating part-time work and above median firm size. Training char.: indicators for the absence of training opportunities at the current workplace, whether workers were denied training previously, whether workers think their job is more demanding than a few years ago, and whether it is possible to accumulate skills through learning-by-doing. Sector: Fixed effects for five sectors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A.5. Balancing

	All	**Treatment**	**Control**	**p-value**
	(1)	(2)	(3)	(4)
Age	40.78	40.71	40.85	0.617
Female	0.50	0.48	0.51	0.050
Weekly hours	36.35	36.39	36.31	0.689
Weekly hours <35	0.21	0.20	0.21	0.344
Higher-skilled	0.46	0.46	0.47	0.659
Professional Degree				
Vocational training	0.35	0.36	0.35	0.489
Technical School	0.16	0.15	0.17	0.058
University	0.45	0.45	0.44	0.481
None/other	0.04	0.04	0.04	0.939
Number of workers at firm	452.95	459.06	446.91	0.369
Years at firm	10.78	10.79	10.77	0.940
Gross monthly earnings	4669.84	4680.99	4658.79	0.793
Observations	3701	1839	1862	3701

Notes: Columns (1) to (3) show sample means for the indicated subgroup. Column (4) shows p-values from t-tests comparing the mean of each variable between treatment and control group. A joint F-test based on regressing a dummy that takes on value one for respondents in the treatment group on all covariates gives a p-value of 0.545.

Table A.6. Prior beliefs

	All	Higher-skilled	Lower-skilled	p-value
	(1)	(2)	(3)	(4)
Beliefs about (non-)pecuniary returns to firm training				
Firm training increases earnings	0.51	0.55	0.48	0.000
Firm training enhances career opportunities	0.74	0.76	0.72	0.002
Beliefs about learning				
Improvement in professional tasks through practice	0.80	0.82	0.78	0.001
Skills brought to the job are more important than effort	0.58	0.57	0.59	0.182
Ease of learning new things in firm training	0.73	0.79	0.68	0.000
Hesitation to attend training due to lack of recent learning	0.22	0.21	0.23	0.246
Indices				
Index: Positive return beliefs	-0.00	0.09	-0.08	0.000
Index: Positive learning beliefs	-0.00	0.14	-0.12	0.000
Observations	3701	1708	1993	3701

Notes: Columns (1) to (3) show sample means of the agreement to our prior belief questions for the indicated subgroup. Respondents were asked about their agreement to the statements on a 5-point likert scale. If a respondent (partially) agrees, the variable is coded as 1 and 0 otherwise. Column (4) shows p-values from t-tests comparing the mean of each variable between higher- and lower-skilled.

Table A.7. Heterogenous treatment effects on training intentions by prior beliefs

	Probability to accept a training offer					
	.. with no costs			.. with costs		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	2.234**	2.791*	3.134**	2.138**	1.944	3.104**
	(0.896)	(1.429)	(1.302)	(1.017)	(1.352)	(1.246)
Treatment x Positive return beliefs		-1.278			0.156	
		(1.777)			(1.999)	
Positive return beliefs		8.949***			12.191***	
		(1.289)			(1.439)	
Treatment x Positive learning beliefs			-2.731*			-2.569
			(1.625)			(2.099)
Positive learning beliefs			17.421***			8.445***
			(1.184)			(1.477)
Treatment effect for positive (return/learning) beliefs		1.513	0.402		2.099	0.536
		(1.050)	(0.968)		(1.472)	(1.686)
Control mean	81.03	81.03	81.03	30.70	30.70	30.70
Observations	3701	3701	3701	3701	3701	3701
Controls	✓	✓	✓	✓	✓	✓

Notes: OLS regressions. Dependent variables: "Probability of accepting a training with no costs" refers to an offer of 80 hours of training fully financed by the employer. In the scenarios "with costs," workers are required to contribute 20% of their current net monthly salary. A standardized summary index is created from the first two items in Table A.6 to capture prior beliefs about returns, while a second index summarizes the next four items to capture beliefs about learning. Both indices are standardized such that higher values indicate more positive beliefs regarding firm training; consequently, items 4 and 6 are reverse-coded. We then perform a median split on each index, creating dummy variables for "positive return beliefs" and "positive learning beliefs," which identify individuals with above-median, or more positive, beliefs in each dimension. Significance of treatment effect on higher-skilled respondents are calculated using post-estimation Wald tests. Control mean: mean of the outcome variable in the control group. Controls: age, dummies for female and ten occupational major groups (KldB 2010), risk preferences and patience. Robust standard errors clustered at the individual level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A.8. Heterogenous treatment effects by workers' age

	Probability to accept a training offer			
	.. with no costs		**.. with costs**	
	(1)	(2)	(3)	(4)
Treatment	2.234**	1.822	2.138**	2.821**
	(0.896)	(1.134)	(1.017)	(1.377)
Treatment x Age > median		0.881		-1.456
		(1.813)		(2.040)
Age > median		-2.645		3.630
		(1.939)		(2.234)
Treatment effect for age > median		2.702*		1.365
		(1.412)		(1.506)
Control mean	81.03	81.03	30.70	30.70
Observations	3701	3701	3701	3701
Controls	✓	✓	✓	✓

Notes: OLS regressions. Dependent variables: "Probability of accepting a training with no costs" refers to an offer of 80 hours of training fully financed by the employer. In the scenarios "with costs," workers are required to contribute 20% of their current net monthly salary. Age > median is a dummy equal to 1 if the respondent is older than the sample median age (42). Significance of treatment effect on higher-skilled respondents are calculated using post-estimation Wald tests. Control mean: mean of the outcome variable in the control group. Controls: age, dummies for female and ten occupational major groups (KldB 2010), risk preferences and patience. Robust standard errors clustered at the individual level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

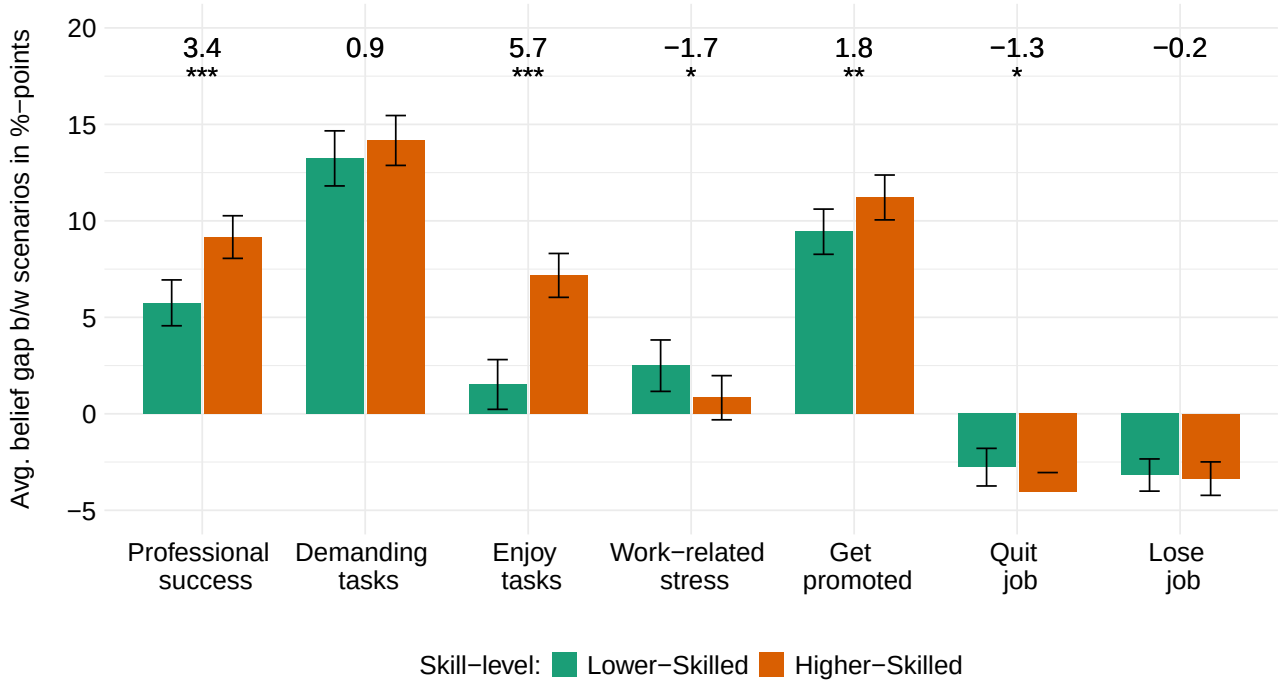
B Robustness to Alternative Definition of Higher-skilled

TABLE B.1. Earnings expectations by workers' skill-level (alternative definition)

	Higher-skilled		Lower-skilled		Difference
	Mean	Std. Dev.	Mean	Std. Dev.	Lower − Higher
	(1)	(2)	(3)	(4)	(5)
Expected earnings in €					
With firm training	6,441	3,333	4,515	2,205	-1,926***
Without firm training	6,057	3,267	4,217	2,100	-1,840***
Individual expected returns					
Absolute	384	927	297	800	-86***
Relative in %	8.60	29.71	8.65	29.15	0.05
Share positive	0.49	0.50	0.53	0.50	0.04**
Observations		1844		1857	3701

Notes: Means and standard deviations are summary statistics of worker-reported expectations of monthly gross earnings by workers' skill-level. Individual expected returns contain summary statistics of workers' perceived absolute and relative re-turns. Relative returns correspond to the within-worker difference in expected earnings across scenarios divided by earnings in the scenario without firm training. All figures are in full-time equivalents. Column (5) is the mean difference. Earnings expectations are winsorized from below at the minimum wage (2,135 €) and from above at the 98th percentile of the German wage distribution (14,583 €). Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

FIGURE B.1. Difference in return beliefs by workers' skill-level (alternative definition)



Notes: N = 3,701. This figure displays average belief gaps between lower- and higher-skilled individuals for each event. Bars show group means with 95% confidence intervals. The number above each pair of bars indicates the mean difference between groups and stars denote significance levels from independent t-tests. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE B.2. Skill gap in firm training intentions (alternative definition)

Dep. Var.: Training Intentions	(1)	(2)	(3)	(4)
Higher-skilled	11.728***	10.430***	2.874***	2.659**
	(1.055)	(1.039)	(1.056)	(1.049)
Beliefs		✓		✓
Worker and firm char.			✓	✓
Training char.			✓	✓
Sector			✓	✓
R^2\$	0.032	0.077	0.213	0.232

Notes: N = 3,701. Coefficient estimates of a dummy indicating whether a worker is higher skilled (alternative definition) in a regression of the probability of participating in firm training next year on varying sets of controls. Beliefs: belief gaps in pecuniary and non-pecuniary dimensions. Worker and firm char.: workers' age, gender, risk aversion, patience, locus of control, and current full-time equivalent earnings, as well as dummies indicating part-time work and above median firm size. Training char.: indicators for the absence of training opportunities at the current workplace, whether workers were denied training previously, whether workers think their job is more demanding than a few years ago, and whether it is possible to accumulate skills through learning-by-doing. Sector: Fixed effects for five sectors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE B.3. Information treatment effects on training intentions (alternative definition)

	Probability to accept a training offer .. with no costs		**.. with costs**	
	(1)	(2)	(3)	(4)
Treatment	2.234**	2.480**	2.138**	1.782
	(0.896)	(1.243)	(1.017)	(1.311)
Treatment x Higher-skilled		-0.516		0.828
		(1.659)		(1.901)
Higher-skilled		2.564**		4.880***
		(1.221)		(1.381)
Treatment effect on higher-skilled		1.964*		2.609*
		(1.189)		(1.474)
Control mean	81.03	81.03	30.70	30.70
Observations	3701	3701	3701	3701
Controls	✓	✓	✓	✓

Notes: OLS regressions. Dependent variables: "Probability of accepting a training with no costs" refers to an offer of 80 hours of training fully financed by the employer. In the scenarios "with costs," workers are required to contribute 20% of their current net monthly salary. Age > median is a dummy equal to 1 if the respondent is older than the sample median age (42). Significance of treatment effect on higher-skilled respondents are calculated using post-estimation Wald tests. Control mean: mean of the outcome variable in the control group. Controls: age, dummies for female and ten occupational major groups (KldB 2010), risk preferences and patience. Robust standard errors clustered at the individual level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

C Robustness to Bad Data

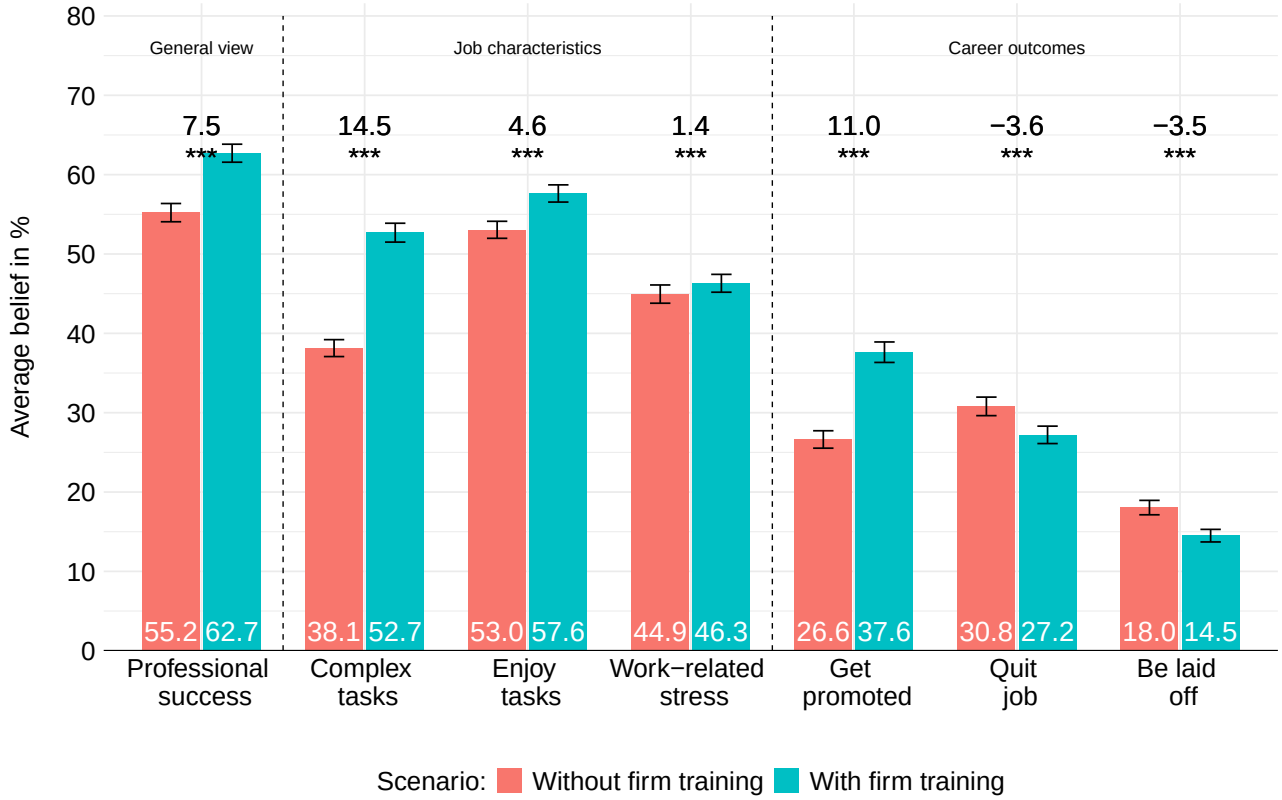
In this section we report our main results only for those individuals who are a reliable type according to the definition by Dohmen and Jagelka 2024.

TABLE C.1. Earnings expectations descriptives (only reliable respondents, N = 2,962)

	Mean (1)	Std. Dev. (2)	Median (3)
Expected earnings in €			
With firm training	5497	2888	4800
Without firm training	5156	2798	4461
Individual expected returns			
Absolute	340	781	100
Relative in %	8.32	25.76	2.27
Share positive	0.51	0.50	1

Notes: N = 3,701. Mean, standard deviation, and median are summary statistics of worker- reported expectations of monthly gross earnings. Individual expected returns contain summary statistics of workers' perceived absolute and relative returns. Relative returns correspond to the within-worker difference in expected earnings across scenarios divided by earnings in the scenario without firm training. All figures are in full-time equivalents. Earnings expectations are winsorized from below at the minimum wage (2,135 €) and from above at the 98th percentile of the German wage distribution (14,583 €).

FIGURE C.1. Beliefs about non-pecuniary returns (only reliable respondents, N = 2,962)



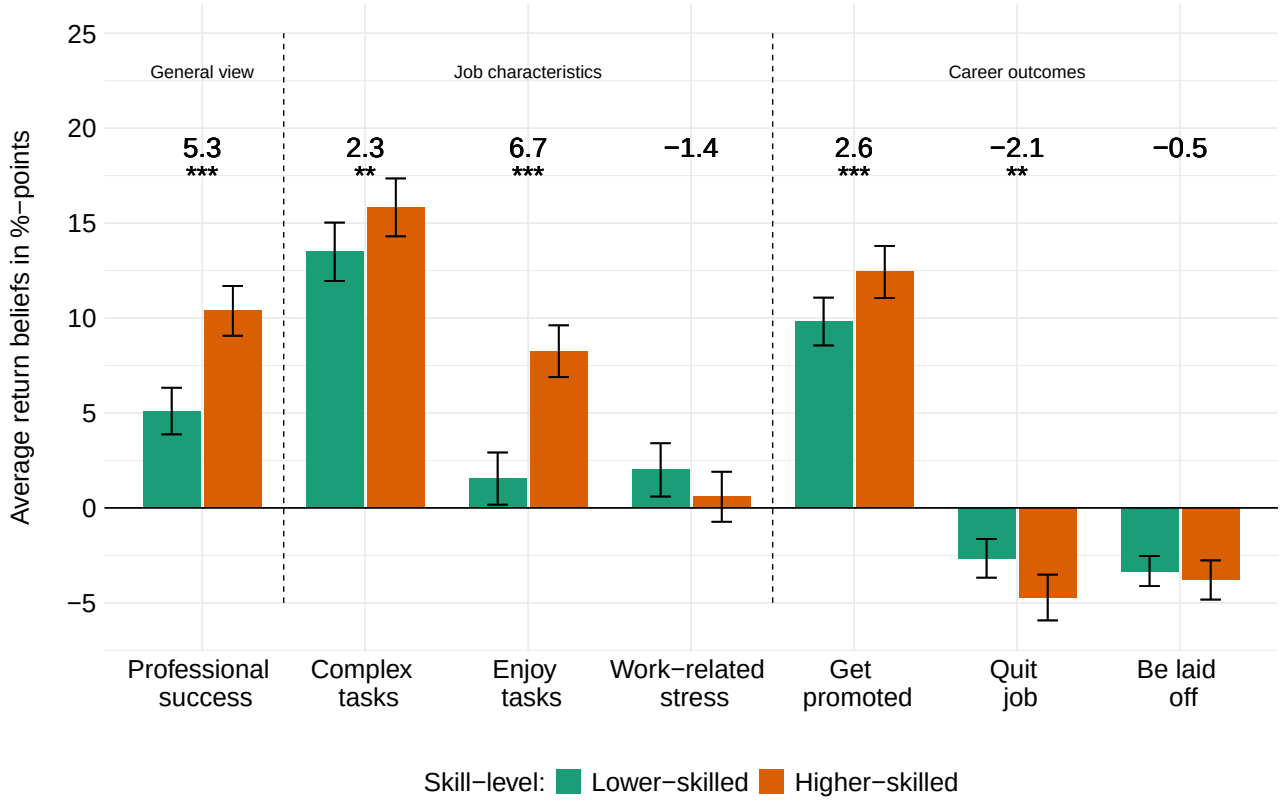
Notes: N = 3,701. This figure displays average probabilities for each event under two scenarios: with and without firm training. Bars show means and 95% confidence intervals. The number above each pair of bars indicates the mean difference between the two scenarios and stars denote significance levels from paired t-tests. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE C.2. Earnings expectations by workers' skill-level (only reliable respondents, N = 2,962)

	Higher-skilled		Lower-skilled		Difference
	Mean	Std. Dev.	Mean	Std. Dev.	Lower − Higher
	(1)	(2)	(3)	(4)	(5)
Expected earnings in €					
With firm training	6,571	3,206	4,609	2,236	-1,962***
Without firm training	6,187	3,153	4,305	2,118	-1,882***
Individual expected returns					
Absolute	384	821	304	745	-80***
Relative in %	8.08	23.73	8.53	27.33	0.44
Share positive	0.49	0.50	0.53	0.50	0.04**
Observations		1993		1708	3701

Notes: Means and standard deviations are summary statistics of worker-reported expectations of monthly gross earnings by workers' skill-level. Individual expected returns contain summary statistics of workers' perceived absolute and relative re-turns. Relative returns correspond to the within-worker difference in expected earnings across scenarios divided by earnings in the scenario without firm training. All figures are in full-time equivalents. Column (5) is the mean difference. Earnings expectations are winsorized from below at the minimum wage (2,135 €) and from above at the 98th percentile of the German wage distribution (14,583 €). Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

FIGURE C.2. Difference in return beliefs by workers' skill-level (only reliable respondents, N = 2,962)



Notes: N = 3,701. This figure displays average belief gaps between lower- and higher-skilled individuals for each event. Bars show group means with 95% confidence intervals. The number above each pair of bars indicates the mean difference between groups and stars denote significance levels from independent t-tests. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE C.3. Information treatment effects on training intentions (only reliable respondents, N = 2,962)

	Probability to accept a training offer			
	.. with no costs		**.. with costs**	
	(1)	(2)	(3)	(4)
Treatment	1.695*	2.875**	1.977*	3.216**
	(0.991)	(1.441)	(1.167)	(1.541)
Treatment x Higher-skilled		-2.499		-2.524
		(1.982)		(2.343)
Higher-skilled		4.317***		7.138***
		(1.438)		(1.714)
Treatment effect on higher-skilled		0.376		0.692
		(1.343)		(1.767)
Control mean	82.75	82.75	30.50	30.50
Observations	2962	2962	2962	2962
Controls	✓	✓	✓	✓

Notes: OLS regressions. Dependent variables: "Probability of accepting a training with no costs" refers to an offer of 80 hours of training fully financed by the employer. In the scenarios "with costs," workers are required to contribute 20% of their current net monthly salary. Age > median is a dummy equal to 1 if the respondent is older than the sample median age (42). Significance of treatment effect on higher-skilled respondents are calculated using post-estimation Wald tests. Control mean: mean of the outcome variable in the control group. Controls: age, dummies for female and ten occupational major groups (KldB 2010), risk preferences and patience. Robust standard errors clustered at the individual level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

D Survey

This section gives an overview over the main questions of our survey. Our measurement of firm training participation, the belief elicitation and the information experiment.

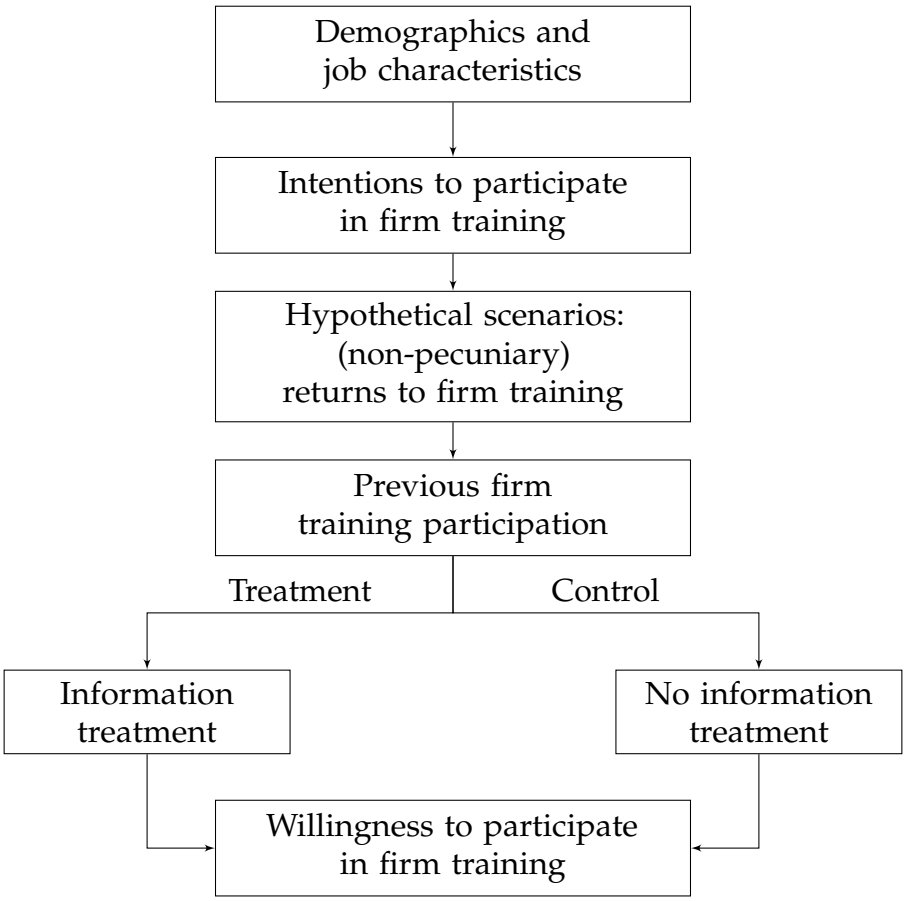


FIGURE D.1. Survey Flow

D.1 Measuring Firm Training Participation

[firm training participation:]
In the following, we ask you a few questions about firm training.

Firm training are courses or events offered by your company to refresh existing professional skills or learn new skills. They are fully or partially financed by your company and can take place both during and outside working hours. Firm training can be provided both externally and internally and can last from a few hours to several months.
How many firm training courses have you attended in the last 12 months?
Please do not include informal learning from your colleagues or learning through experience.
Please enter "0" if you have not taken part in any firm training.

- .... firm trainings

[new page:]
Now, we would like to ask about the time you have spent on firm training in the past 12 months. How many full hours have you spent on firm training in total over the last 12 months?
If you do not know exactly, please estimate.

[new page:]
How many days were the <embedded field> training courses that you took part in last year, amounting to <embedded field> hours, divided into?

[new page:]
Have you already taken part in firm training since you started working for your current employer?

- Yes/No

[new page, firm training intention:]
In the next questions, please rate how likely it is that certain events will occur. To do this, we ask you to enter a number between 0% and 100%. The percentage values correspond to the probability that an event will occur. 0% means completely ruled out, and 100% means absolutely certain. You can choose any number between 0% and 100% that you think best corresponds to the probability of the event.

How likely is it that you ...

- ... participate in firm training totaling at least 40 hours (equivalent to about 1 week full-time) in the next year? ... % (0 - 100)
- ... participate firm training of at least 40 hours per year (equivalent to about 1 week full-time) every year until the end of your working life? ... % (0 - 100)

D.2 Belief Elicitation

[non-pecuniary beliefs:]
We now ask you to think about the future of your professional life. This question is of great importance to us, so please answer it as accurately as possible.

Please imagine the following two scenarios:

Scenario 1	**Scenario 1**
Every year until the end of your working life, you take part in **firm training** totaling **80 hours per year** (equivalent to around 2 weeks full-time).	You **do not take part** in **any firm training** until the end of your working life.

Please answer the following questions for the two scenarios. We ask you to enter a number between 0% and 100%. 0% means completely ruled out, and 100% means absolutely certain. You can use the values in between to scale your answer.

	With firm training (0 - 100)	**Without firm training (0-100)**
Now, we would like to ask about your expectations for the year 203. How likely is it that you...		
... enjoy your day-to-day professional tasks in 2030?		
... have a lot of stress at work in 2030?		
... take on more demanding tasks in 2030 than today?		
... be promoted at least once by the year 2030?		
... quit your current job by the year 2030?		
... be laid off from your current job by 2030?		
... be successful in your professional life in 2030?		

[new page, earnings beliefs:]
Now, we would like to ask about your expectations regarding your salary development.

Please continue to imagine the two scenarios.

Assume that you will work the same number of hours as you do today. Please disregard the effects of inflation on wages. This means that one euro today is worth the same as one euro in the year 2030. What do you think your average gross monthly salary will be in 2030 in both scenarios?

Your current gross monthly salary: [insert value]

	With firm training (0 - 100)	**Without firm training (0-100)**
Expected gross monthly salary in 2030		

D.3 Information Experiment

[prior beliefs:]
In the following, we would like to ask you a few questions about learning in the workplace

and continuing professional development.
How much do you agree with the following statements? (I strongly agree, I tend to agree, neither, I tend to disagree, I strongly disagree)

- By participating in firm training, my salary increases in the long term.
- Taking part in firm training improves my career opportunities in the long term.
- I can get better at my professional tasks by practicing.
- More important than all efforts are the abilities one possesses.
- It would be easy for me to learn new things as part of further training.
- The fact that I am no longer used to learning prevents me from taking part in firm training.

[new page, information treatment:]

> Participation in further training ensures that employees' skills keep pace with technological change. Studies of the German labor market have shown that firm training protects against job loss and often leads to higher wages in the long term.
>
> After a long break from learning, learning new skills through firm training can seem challenging. However, numerous studies show that you can improve or relearn your skills through regular practice well into old age.

[new page, probability of accepting training offer:]
Imagine your employer offers you the opportunity to take part in 80 hours of firm training (equivalent to about 2 weeks full-time) that takes place during working hours. Please enter a number between 0% and 100% for each of the following questions. 0% means completely ruled out, and 100% means absolutely certain. You can choose any number between 0% and 100% that you think most closely corresponds to the probability of the event.

How likely is it that you will accept the offer...

- ... if the employer fully covers the costs of the firm training? ...%
- ... if part of the costs of firm training amounting to 20% of your current net monthly salary have to be payed by yourself: ... %