



Original research article



# ‘Crafts are great, but not for me’: Reconnecting to the skilled trades crucial for building a low-carbon implementation workforce in academised societies

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## ABSTRACT

Developing a sufficiently skilled and large workforce in the skilled trades constitutes a crucial bottleneck for implementing low-carbon transitions globally. However, research on strategies to increase apprentice numbers in vocational education and training (VET) in these Climate Crafts remains limited. Here, we examine the appeal of Climate Crafts among German adolescents. Grounded in the Social Cognitive Career Theory, the ordinal logistic regression results of a survey experiment ( $N = 1280$ ) reveal that low degrees of practical self-efficacy, perceived approval from parents and peers, and limited knowledge about the skilled trades deter adolescents from apprenticeships in the Climate Crafts. Additionally, the sector remains an unattractive field for women and adolescents with or aspiring to A-levels. The latter regard Climate Crafts as generally attractive but personally ill-fitted occupations indicating that strategies targeting the perceived personal job fit for high-school students could be effective in increasing application numbers from this group. Moreover, highlighting earning opportunities was associated with an increase in attractiveness in this sample. Our results indicate a disconnection from manual labour in academised societies and signpost a priority agenda for practice and policymaking. Increasing practical learning in schools, facilitating social mixing between academics and tradespeople, and raising awareness about the Climate Crafts could foster re-connection. Trusted ‘influencers’ could increase the social prestige of these professions through public communication. Craft actors need to adapt VET to the preferences of the young generations and policymakers need to equip VET with similar resources as academic education.

## 1. Introduction

The shortage of skilled workers increasingly constitutes a barrier to accelerating low-carbon transitions in many countries worldwide [1–3]. Particularly professions in the skilled trades requiring vocational education and training (VET) such as electricians or heating installers are crucial implementers of low-carbon technologies [4–6] and evolve into severe bottleneck professions bracing low-carbon transitions [7]. Although demand for these professions is growing due to energy transitions and digitalisation, workforces in vocational jobs have been

declining in many countries such as China, the United States, and European Union member states [7,8]. Reasons for this decline are manifold and vary across geographies but include an over proportionally ageing (and retiring) workforce in the skilled trades [7], academisation meaning growing preferences among young people for university education over VET [9], and an increasing number of young people not in employment, education, or training (NEETs) [10]. Therefore, the question of how to attract and retain enough people in these vocational jobs becomes a pivotal element for governing low-carbon transitions.

Accordingly, many countries adopted policy frameworks to address

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skill shortages such as the European Skills Agenda from 2020 [11]. These policies mainly focus on up- and reskilling the existing workforce and developing new training content [1,7]. Yet, awareness is growing that, in many countries, the bigger challenge in tackling skill shortages is the attraction and retention of new workers rather than the upskilling of the existing workforce [8]. Respective strategies comprise an array of measures including enhancing employment opportunities for seniors [12], providing better job perspectives for women [13,14], bringing NEETs into apprenticeships [10], and encouraging immigration of skilled workers from third countries [15]. However, particularly enhancing the appeal of VET to younger generations is regarded as a crucial pillar in tackling the skilled worker shortage in vocational jobs [9,16,17]. Consequently and as a response to European industry associations' critiques for not doing enough in this regard [18], the European Commission and member states launched an image campaign to raise awareness for and reputation of climate-related jobs and a Year of Skills in 2023 [19]. Similar campaigns have been launched in other countries including the United Kingdom [20]. In Germany, the Central Association of Skilled Crafts and Trades and subordinate associations have been running image campaigns for craft professions since 2010 including ones focussing on 'Climate Crafts'<sup>2</sup> (e.g. 22) employing billboard and social media campaigns as well as promotional films. More recently, governments on federal, state, and municipal levels have also launched campaigns for these vocational professions in Germany (e.g. [23]).

However, despite the broad recognition of the problem in policy-making and practice, research on factors influencing the career choice for (or against) the skilled trades and respective campaign messaging remains limited. Therefore, this study aims to advance the scientific basis essential for developing effective strategies for tackling the skill shortage in low-carbon transitions, including image campaigns. Based on an original online survey ( $N = 1280$ ) among German adolescents and applying Social Cognitive Career Theory, it pursues the following research questions:

1. What factors influence adolescents' decision to pursue or avoid a career in the Climate Crafts?
2. How do different occupational framings of such Climate Crafts enhance their appeal to adolescents?

Germany constitutes an insightful case for the international context because it adopted ambitious policies for renewable energy expansion in 2022, for example tripling annual photovoltaic (PV) installation targets from 7.2 GW in 2022 to 22 GW in 2026 [24]. Consequently, Germany needs to develop a PV workforce which is projected to be the largest in the EU by 2027 [25]. However, shortages of 216,000 skilled workers in PV and wind power already hampered their expansion in 2022, with the vast majority of jobs requiring VET [26]. Moreover, as in most other countries, Germany's skilled trades workforce is declining and female shares are below 0.5 % and 1.5 % in the two bottleneck professions facing the highest shortages, electricians and heating installers, respectively [26,27]. Therefore, our study's relevance transcends its geographical focus. On the one hand, it yields implications for policy-making and practice in countries resembling Germany in that they have implemented policies stipulating renewable energy deployment and now face skills shortages. On the other hand, the case provides insights for countries in "earl[ier] transition stages" [28] (p. 1) which will likely be confronted with similar challenges once stipulating policies are implemented.

The remaining paper is structured as follows. The next section reviews the literature on the attractiveness of apprenticeships and skilled

trade occupations as well as on recruitment messaging. It highlights substantial research gaps, particularly concerning vocational occupations in the renewable energy sector. Section 3 introduces Social Cognitive Career Theory (SCCT) as the theoretical framework and establishes our hypotheses derived from SCCT and the literature review. Section 4 describes our methods and research approach. Results are presented in section 5 and discussed regarding scientific contributions and implications for policymaking and practice in section 6. Section 7 concludes.

## 2. Literature review

### 2.1. Appeal of apprenticeship and the skilled crafts and trades

For decades, research has consistently found low appeals of VET and skilled trades occupations among adolescents, manifesting in a continuous decrease in apprenticeship numbers, both in Germany and internationally [17,27,29]. Already in 2003, more than two-thirds of German high-school students did not perceive VET as attractive [30]. This trend has been attributed to the growing preference among young people for tertiary education over VET, also referred to as the 'academisation of society' [31]. Yet, previous research studied the appeal of skilled trade occupations in a broader context while, to our knowledge, no study has yet focussed on the appeal of vocational occupations within the renewable energy sector. In fact, apprenticeship numbers in the here-studied Climate Crafts have been increasing in Germany in the last years against the main trend in other skilled trades [32]. The following paragraphs briefly present how existing research found education, personal career values and interests, environmental factors, gender, knowledge, and the perception of skilled trade job attributes to influence adolescents' evaluation of the sector.

Educational background is a primary determinant of the appeal of skilled trades in that particularly high-school students perceive skilled trade jobs as not suitable for their educational level [30,33]. Historically, occupations requiring an academic degree have enjoyed higher societal prestige than VET because access to higher education was restricted to a minority [9]. Yet, the liberalisation of access to higher education from the 1960s onward enabled adolescents from diverse backgrounds to aspire to more prestigious academic careers as an alternative to apprenticeship [34]. Although recent studies indicate that an increasing number of adolescents with university entrance qualifications are interested in apprenticeships, especially university dropouts, most apprentices still only accomplish lower education [35].

The effect of educational background transcends beyond adolescents to their parents. Parental education considerably influences the attractiveness assessment of the skilled trades among their children: high parental education is associated with a lower likelihood of a positive assessment of skilled trades among their children while children are more likely to assess the skilled trades as attractive if one of their parents worked in the skilled trades themselves [33]. This creates educational 'path dependencies'. Generally, the predominant influence of parents and peers on adolescents' career decisions is well-established in the literature [36,37]. This also pertains to adolescents in Germany where a representative survey found in 2019 that 89 % of 19 to 24-year-olds consider their parents the primary source of career information, followed closely by peers [38].

Moreover, gender substantially affects adolescents' attractiveness assessment of skilled craft jobs [31]. Due to stereotypical socialisation and societal influences, women tend to prefer careers in fields like Commercial and Service Professions while men show a greater inclination toward skilled trade jobs [39–41]. Mischler and Ulrich [33] found that especially the physical and technical aspects of skilled trades decreased the perceived attractiveness among girls, while the same features increased the attractiveness for boys.

The expanded access to tertiary education and 'educational path dependencies' resulted in diminished exposure and disconnect of

<sup>2</sup> Following the suggestion of Wehden et al. [21], we use the term Climate Crafts as an umbrella term for the skilled trades electricians, HVAC installers, and roofers. These trades are crucial for installing rooftop photovoltaics, low-carbon heating systems, or charging infrastructure for electric vehicles.

adolescents to vocational jobs. Hence, knowledge about these occupations in the general population is low, particularly in academic segments. A representative survey of 3500 German adolescents with A-levels from 2016 found that only 38.9 % perceived themselves as well-informed about non-academic careers, while 57.8 % felt similarly about academic options [42]. However, previous research suggests that knowledge about vocational jobs is a crucial determinant for assessing these jobs as attractive [33]. This pertains also to the knowledge about the involved activities and job characteristics. Typically, adolescents perceive the skilled trades to provide low wages, limited career opportunities, and low social prestige, and regard physical labour as unattractive [30,33]. This trend also extends to the general population in Germany [43]. Yet, existing studies primarily explored perceptions on the entire skilled crafts and trades while dedicated studies on the Climate Crafts remain missing, hence the focus of this paper. Since knowledge about and experience with skilled trades is generally low, perceptions and beliefs about the trades may be biased or unrealistic – thus, targetable by messaging as is the subject of the succeeding subsection.

## 2.2. Recruitment messaging

Research on recruitment messaging also lacks focus on the skilled trades. The limited existing research focused on making the sector more attractive to women (e.g. 14) or the effectiveness of media outlets such as social media in reaching adolescents [44] rather than the message content itself. Smith's study on the attractiveness of apprenticeships [9] constitutes a notable exception. Therefore, the review collates findings from other sectors, primarily the public sector which has been the focus of most studies.

This literature suggests that personal attractiveness ratings are predictors for actual application and can be shaped by message content [45,46]. The most influential predictor of personal attraction is perceived personal job fit which describes the alignment between an individual's values and task expectations with the requirements of a job [47]. If the values targeted in the messages align with an individual's values, this triggers a need for self-continuity and increases the perceived personal job fit and attractiveness [48–50]. Thereby, research on recruitment messaging broadly differentiates between intrinsic and extrinsic values. Intrinsic values refer for example to personal self-growth and contributing purposefully to society. Individuals who are more motivated by extrinsic value rather seek occupational status and financial rewards [49]. Therefore, recruitment messages aiming to convey a positive image of an occupation or sector should highlight intrinsic or extrinsic values, depending on the target group.

Since growing the workforce in the Climate Crafts requires diversification and expanding the target groups beyond the conventional to 'unlikely' groups, effectively targeting these unlikely groups becomes crucial. Existing research shows that messaging that engages and resonates with specific demographics is most effective in increasing attractiveness among unlikely groups [48]. In their work on public sector jobs, Taniguchi et al. [51] and Schuck [52] showed that tailored messaging recognising and addressing unique concerns faced by women and People of Colour increases the likelihood of them applying for respective positions. Additionally, Linos [48] showed that presenting unknown and new aspects of the work of police officers increases the likelihood of usually unlikely individuals applying for police traineeships. Thus, job advertisements which merely echo well-known job characteristics likely only attract already inclined individuals. Instead, attracting unlikely applicants requires job advertisements to transcend societal expectations and present new compelling aspects of the job. Smith's work [9] substantiates these conclusions for apprenticeships and further suggests that recruitment messaging for apprenticeships should also target the broader social circle of potential applicants, including parents, peers, and schools.

## 3. Theoretical framework and hypothesis development

### 3.1. Social cognitive career theory (SCCT)

This study employs Social Cognitive Career Theory (SCCT) as its theoretical framework. SCCT provides a comprehensive explanation of how individuals develop career interests, set goals, and make choices [53]. Other career theories, such as trait-factor models [54] and developmental theories [55] focus on static traits or life stages rather than the dynamic interplay of personal, behavioural, and contextual factors. SCCT unifies the two key strands of social-cognitive career theories – one emphasising individual interests [56] and the other highlighting contextual influences [39] – into a widely adopted, holistic model [53]. SCCT has been widely applied across different age groups [57] contexts and populations [58,59], and various occupations [60]. Although it has not yet been used to study craft jobs, robust meta-analytic findings support its applicability in this context.

SCCT posits that career interest development and decision-making are influenced by a dynamic interplay of individual and contextual factors. Individual factors include personal attributes such as gender, health, predispositions, and ethnicity. Contextual factors encompass both real and perceived environmental influences – such as educational opportunities and financial resources [61]. As Fig. 1 shows, individual and contextual factors directly affect the formation of individuals' career interests and subsequent decision-making. However, these factors mainly affect career interests indirectly through influencing learning experiences. These experiences shape individuals' perception of occupations which, in turn, influences self-efficacy beliefs and outcome expectations. In SCCT, self-efficacy refers to the belief in one's ability to successfully perform specific tasks while outcome expectations relate to the anticipated results of engaging in those tasks, such as material rewards, social prestige, or personal satisfaction. Together, self-efficacy and outcome-expectations form career interests, which constitute the crucial first step in the career decision-making process, as they shape personal job goals and ultimately influence actual career choices [53]. Career interests are defined as patterns of likes, dislikes, and indifference toward career-relevant activities.

### 3.2. Hypothesis development: Effects of predictors on job attractiveness as a proxy for career interest in SCCT

Following the approach of previous studies, we use job attractiveness as a proxy for career interest [33,45,50]. Specifically, we follow the approach of Mischler and Ulrich [33] and distinguish between general and personal attractiveness. General attractiveness captures individuals' overall assessments of an occupation's attractiveness regardless of the personal interest in this occupation. Personal attractiveness describes how attractive individuals find an occupation for themselves personally and thereby measures occupational interest more directly. Although not an original element of SCCT, Mischler's and Ulrich's empirical evidence from Germany suggests that, for craft professions, general and personal attractiveness ratings can diverge and could be influenced differentially by the predicting variables. While both measures can be used as proxies for career interest in the SCCT framework, differentiating between personal attraction to an occupation and the general assessment of its attractiveness recognises empirical insights from Germany and allows for a more nuanced analysis than just eliciting one blanket measure.

This study investigates the main predictors for job attractiveness according to SCCT, self-efficacy and outcome expectations. The following paragraphs briefly present the associated hypotheses.

#### 3.2.1. Self-efficacy

In occupational settings, self-efficacy translates into the question "Can I do this?" [59], p. 83 and describes an individual's confidence in successfully performing tasks related to a particular occupation. It develops through four key learning experiences: personal achievements,

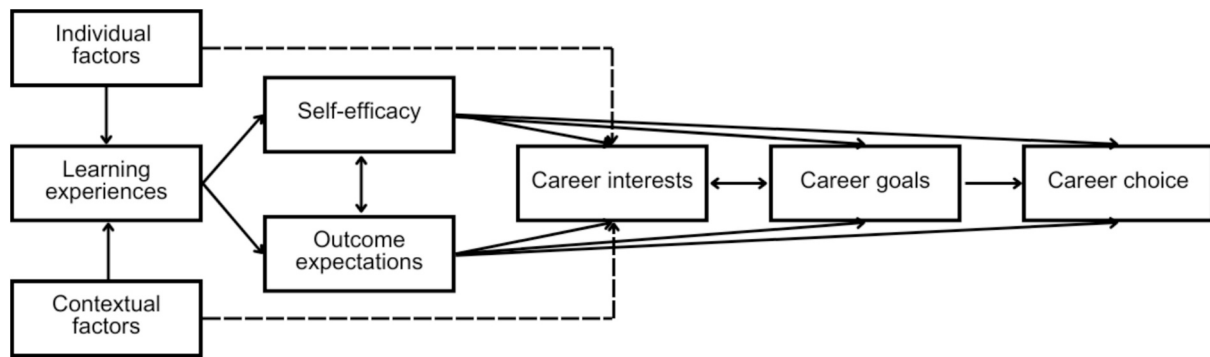


Fig. 1. Model of Career choice according to SCCT (own figure, adapted from Lent et al. [53]).

observing others, social encouragement, and emotional and physical responses [62]. As a result, individuals are more likely to be drawn to and develop interest in a profession when they strongly believe in their ability to meet its demands. Research shows that high occupational self-efficacy positively influences career interest and career choice [60], also for craft professions [30,63]. However, to our knowledge, no studies have explored the impact of craft-related self-efficacy<sup>3</sup> on the attractiveness of Climate Craft occupations. To address this gap, the first hypotheses are as follows:

**H1a.** The higher adolescents' self-efficacy beliefs, the greater the perceived general attractiveness of Climate Craft occupations.

**H1b.** The higher adolescents' self-efficacy beliefs, the greater the perceived personal attractiveness of Climate Craft occupations.

### 3.2.2. Outcome expectations

Outcome expectations in SCCT encompass the anticipated results of pursuing a particular career, which can be material (e.g., income), social (e.g., peer or parental approval), or self-evaluative (e.g., personal satisfaction). Empirical evidence across various domains supports SCCT's proposition that individuals are more likely to be interested in and choose careers where they expect positive outcomes [57,58,64].

**3.2.2.1. Parental and peer approval.** Studies reviewed in section 2.1 suggest that parental and peer approval has a significant impact on adolescents' attractiveness assessment. Therefore, this paper examines the following hypotheses:

**H2a.** The more adolescents expect approval of VET in the skilled trades from their parents and peers, the greater their perceived general attractiveness of Climate Craft occupations.

**H2b.** The more adolescents expect approval of VET in the skilled trades from their parents and peers, the greater their perceived personal attractiveness of Climate Craft occupations.

**3.2.2.2. Experimental stimuli.** As illustrated in section 2.1 and 2.2, knowledge about the skilled trades and respective job characteristics is low. Thus, making different and novel aspects of jobs more salient through experimental stimuli might enhance attractiveness assessments by increasing respective outcome expectations. Therefore, the following hypotheses relate to effects of targeting three different outcome expectations through experimental stimuli.

**3.2.2.3. Stimulus: Environmental impact.** A key job characteristic of Climate Crafts is their environmental impact. Research showed that the

<sup>3</sup> <sup>2</sup> For the purpose of readability and conciseness, we just use the term 'self-efficacy' hereafter to refer to the confidence in one's craft-related skills and capabilities.

current adolescent generation ('Generation Z') is particularly concerned with climate change and environmental sustainability and prioritises careers that allow them to contribute positively to society and the environment [38]. Since previous studies identified a lack of awareness among adolescents about the environmental contributions of these jobs, emphasising Climate Crafts' environmental impact could increase their appeal to environmentally conscious adolescents. This seems explicitly relevant for adolescents with higher education (as is the focus of this study, see section 4) since Reibold and Rasch [65] found that while environmental concerns were only of minor importance for the job choice of current apprentices in Germany, they were much more important among those apprentices with A-levels. Therefore, we propose the following hypotheses:

**H3a.** Emphasising the positive environmental impact of Climate Crafts increases their general attractiveness among adolescents.

**H3b.** Emphasising the positive environmental impact of Climate Crafts increases their attractiveness among adolescents.

**3.2.2.4. Tangible results.** Moreover, professional fulfilment and satisfaction constitute critical career outcomes. The ability to see tangible results of 'a day's work' is widely considered a characteristic feature of craftwork [43]. Scholars argued that this characteristic increases professional fulfilment in contrast to 'Taylorist' office or factory work [66] and is a prime reason for the high job satisfaction in the German skilled crafts and trades sector [67]. Thus, highlighting the tangible results of Climate Crafts and how these contribute to society could enhance their attractiveness to adolescents. Accordingly, we propose the following hypotheses:

**H4a.** Emphasising the tangible results of Climate Crafts increases their general attractiveness among adolescents.

**H4b.** Emphasising the tangible results of Climate Crafts increases the personal attractiveness among adolescents.

**3.2.2.5. Income and career opportunities.** Lastly, material outcome expectations, such as income and career progression opportunities, play a significant role in career decision-making [38,47,53] and have been identified as major deterrents for young people considering careers in skilled trades [30]. The study therefore posits the following hypotheses:

**H5a.** Emphasising the income and career opportunities of craft jobs increases the general attractiveness of Climate Craft occupations among adolescents.

**H5b.** Emphasising the income and career opportunities of craft jobs increases the personal attractiveness of Climate Craft occupations among adolescents.

## 4. Methodology

All materials are made available in the online Supplementary Material at [https://osf.io/5uqsb/?view\\_only=02a45b49eab84996a674d1c7d119d612](https://osf.io/5uqsb/?view_only=02a45b49eab84996a674d1c7d119d612).

### 4.1. Design and participants

To examine predictors of job attractiveness, we conducted a one-factorial between-subjects experiment via an online survey. This method enabled us to evaluate the impact of three different message framings on participants' perceptions of personal and general job attractiveness, compared to a control group. Participants were randomly assigned to one of four groups, with each group receiving one of the three framing conditions—emphasising environmental impact, tangible results, or income expectations—or no framing in the control group. Additionally, we investigated the role of self-efficacy as well as peer and parental approval. Building on SCCT, we expected these factors to predict job attractiveness regardless of the framing.

The main survey was conducted in November 2023, targeting German adolescents aged 16 to 25.<sup>4</sup> We commissioned the online panel provider *Bilendi* to recruit and compensate participants for successful completion. *Bilendi* ensured approximate gender balance and implemented our sampling emphasis on adolescents holding or aspiring to university entrance qualifications. We deliberately focussed on these groups, first, because these adolescents can choose between vocational and academic education. Second, the skill shortage in Climate Crafts not only exists at the level of journeymen (skilled workers) but also at the level of master craftspeople (experts) [26]. Due to the growing complexity of the Climate Crafts [21], there is a special need to attract cognitively high-performing individuals into these occupations who are more likely to pass the exams on the higher qualification levels and cope with the cognitive complexity of the Climate Crafts.

The survey was designed to be completed within twelve minutes. The empirical median completion time was 8 min and 36 s. After removing data from participants who speeded and completed the survey under 5 min and 15 s the final sample consisted of 1280 valid responses out of an initial pool of 3405 participants. The final sample was evenly distributed across the experimental conditions, with approximately equal numbers of participants in each group (see 'Randomisation Check' in Supplementary Material). 59.7 % of participants were female, the mean age was 20.7 (SD = 2.88). Three quarters (75.4 %) attained or expressed a desire to attain university entrance qualification. The detailed distribution is shown in Table 1.

### 4.2. Procedure and materials

The questionnaire was structured into four sections. After obtaining informed consent, the first section measured constructs which were treated as independent variables and controls in our analysis. Participants were then exposed to the stimuli.<sup>5</sup> The final section measured the constructs used as dependent variables. The exact wording and English translation of the questions and items can be found in the Supplementary Material 'Questionnaire'. The questionnaire contained further

<sup>4</sup> A pretest with 30 participants (median age = 20, SD = 5) was conducted to assess the clarity, readability, and credibility of the materials (measured on a scale from 1 to 5). Feedback showed strong readability (mean = 4.15) and content credibility (mean = 4.12), but low source credibility (mean = 3.12). As a result, the source was revised from a neutral career information center to a career advice center to improve credibility.

<sup>5</sup> A treatment check ensured participants read the stimulus material by asking a multiple-choice question, including a general statement true for all conditions. Only those who answered correctly could proceed; others were screened out.

**Table 1**

Sample composition of the online youth survey among German adolescents.

| Variable                        | Male (N = 516) |            | Female (N = 764) |            |
|---------------------------------|----------------|------------|------------------|------------|
|                                 | mean ± SD      |            | mean ± SD        |            |
| Age                             | 22 ± 3.0       |            | 20 ± 2.6         |            |
|                                 | n              | percentage | n                | percentage |
| Education*                      |                |            |                  |            |
| low                             | 187            | 36 %       | 128              | 17 %       |
| high                            | 329            | 64 %       | 636              | 83 %       |
| Employment and education status |                |            |                  |            |
| high-school student             | 109            | 21 %       | 253              | 33 %       |
| dual education                  | 41             | 8 %        | 62               | 8 %        |
| university student              | 135            | 26 %       | 326              | 43 %       |
| employed                        | 185            | 36 %       | 47               | 6 %        |
| other                           | 46             | 9 %        | 76               | 10 %       |

\* participants with or aiming for university entrance qualification are coded as 1 (high education) and others as 0 (low education)

measures beyond the ones analysed in this paper that we collected to address a related research question, see [63].

The following paragraphs outline the operationalisation of self-efficacy, parental and peer approval, as well as the control variables. The subsequent section introduces the stimulus material.

#### 4.2.1. Self-efficacy and parental and peer approval

Occupational self-efficacy was measured using a modified three-item scale adapted from the German version developed by Knispel et al. [68]. This scale was specifically adjusted for this study, focusing on participants' confidence in their ability to succeed in skilled trades rather than their performance in an existing job. The original five-item scale was reduced to three items to avoid redundancy and ensure relevance to the research context. The resulting scale demonstrated good internal consistency (Cronbach's  $\alpha = 0.77$ ), validating its use in creating a mean index for the subsequent analysis.

Parental and peer approval was measured using an adapted scale from Wilbourn et al. [69] which was modified to explicitly capture the influence of both parents and peers on career choices in skilled trades. The reliability of this adapted scale was high (Cronbach's  $\alpha = 0.84$ ), justifying the creation of an index.

#### 4.2.2. Controls

Since existing literature showed that gender, education, and knowledge about skilled trade occupations substantially influence adolescents' perceptions of occupations (see section 2.2), we included these variables as controls. Aligning with the SCCT framework, these controls represent individual and contextual factors shaping learning experiences and directly impacting career interests (see Fig. 1). Moreover, we asked participants to indicate to what extent they seek environmental protection in their careers.

For education, we created a binary variable coding participants with or aspiring to university entrance qualifications as 1 (high education) and those without as 0 (low education). Following existing approaches [33], we elicited knowledge about skilled trades through a single-question self-assessment (see Supplementary Material 'Questionnaire', Q11). Finally, to examine aspirations to impact climate change in future careers, we created a new construct, green career commitment, using three items measured on a 5-point Likert scale (see Supplementary Material 'Questionnaire', Q10). Reliability was high (Cronbach's  $\alpha = 0.84$ ), allowing for the creation of a mean index for analysis.

#### 4.2.3. Stimulus material

Participants in all conditions read a short text about the shortage of skilled workers in the "Trades of the Future" and these professions' involvement in "socially important projects such as housing construction, the energy transition, and digitalisation". Vignettes counted approximately

150 words to maintain participant attention and prevent cognitive overload [70]. We deliberately opted for text-only stimuli to focus participants' attention on the content without introducing potentially confounding visual distractions. Specific key phrases within the texts were bolded to draw attention and improve recall, leveraging neuropsychological research that indicates such formatting enhances reader engagement and information retention [71]. The stimuli were also designed to reflect credible sources. All texts were attributed to a career information centre to enhance the perceived professionalism and neutrality of the information, thereby reducing the likelihood of source-based bias [72]. Complete stimuli are provided in Supplementary Material 'Stimuli Construction'.

We deliberately used the term "Trades of the Future" for two reasons. First, this allowed us to focus on the trades of HVAC installers, electricians, and roofers and their involvement in societal projects instead of referring to skilled crafts and trades in general. This minimised the likelihood of participants resorting to their pre-existing beliefs and stereotypes about skilled crafts and trades and made the shortage of workers in these trades salient. Second, we used this term instead of Climate Crafts to prevent participants across all groups from associating the presented trades primarily with climate change. This careful design allowed us to isolate the effects of the three specific message framings on perceived job attractiveness. Specifically, we emphasised aspects relating to these professions' *environmental impact*, their *tangible results*, and *income expectations*.

The three experimental groups each received an additional paragraph of 85 to 95 words that introduced the specific framing. These paragraphs were designed to maintain consistency in structure and length, ensuring that any differences in responses could be attributed to the framing rather than to variations in presentation. The first sentence emphasised the main message, followed by examples related to HVAC installers, electricians, and roofers. The examples highlighted different aspects of tasks and outcomes associated with these jobs, depending on the framing.

The *environmental impact framing* focused on the environmental benefits rather than the manual labour itself and emphasised the potential of these jobs to mitigate climate change. The *tangible results framing* emphasised the hands-on, manual creation of visible goods which provide benefits to other people (e.g. shelter or digitalisation). The *income framing* focused on the financial opportunities associated with the Trades of the Future and compared the median income of a master craftsperson in the respective trades with the median wage in Germany.

The control group only received the introductory paragraph about the Trades of the Future and the current skilled worker shortage. This approach was informed by literature suggesting that simply priming a topic can significantly impact the dependent variable [73]. Had the control group received a text unrelated to skilled trades, it could have skewed the results by making the Trades of the Future salient only to participants in the experimental groups.

### 4.3. Analytical approach

To test the hypotheses, we employed ordered logistic regression. We estimated two separate models for general and personal attractiveness. Both models included dummy variables for the experimental conditions (message framings), occupational self-efficacy, and parental and peer approval as independent variables as well as gender, education level, and green career commitment as controls. All analyses were conducted in R.

The ordered logistic regression models were specified as follows:

$$\log\left(P\left(\frac{Y_{\leq j}}{Y_{> j}}\right)\right) =$$

$$\begin{aligned} &\alpha_j + \beta_{j1} \text{Dummy Purpose Treatment} \\ &+ \beta_{j2} \text{Dummy Climate Change Treatment} \\ &+ \beta_{j3} \text{Dummy Income Treatment} + \beta_{j4} \text{Selfefficacy} \\ &+ \beta_{j4} \text{parental and peer influence} + \beta_{jk} X_k \end{aligned}$$

where  $\log\left(P\left(\frac{Y_{\leq j}}{Y_{> j}}\right)\right)$  depicts the logarithm of the odds that the dependent variable general/personal attractiveness is in a category greater than  $j$ , compared to being in or below category  $j$ .  $\alpha_j$  is the intercept for each category  $j$  and  $\beta_{j1}$  to  $\beta_{j3}$  represent the coefficients for the three experimental groups, in reference to the control group. Additionally,  $\beta_{j3}$  to  $\beta_{j4}$  stand for the coefficients for self-efficacy and parental and peer approval and  $\beta_{jk} X_k$  denotes the additional control predictors in the model. To avoid violations of model assumptions, we relied on the R package VGAM [74] to relax the proportional odds assumption. For a more detailed description, readers may refer to the Supplementary Material 'Additional information on analytical procedure'.

## 5. Results

This section presents the statistical results for all hypotheses including the effect of control variables on the perceived attractiveness of Climate Craft occupations among adolescents. Findings are reported using odds ratios,  $p$ -values, and predicted probabilities to illustrate the relationships observed. Results of the ordinal regression analysis for general and personal attractiveness are displayed in Tables 2 and 3, respectively.

### 5.1. Self-efficacy

The first hypothesis (H1a) proposes that higher self-efficacy beliefs among adolescents would lead to an increased perceived general attractiveness of Climate Craft occupations. The results support this hypothesis, as the odds ratio for the self-efficacy index is 1.30 ( $p < 0.001$ , SE = 0.08). This means that for each one-unit increase in self-efficacy, the odds of perceiving the crafts sector as more generally attractive increase by 30 %, holding all other variables constant. The predicted probabilities provide further clarity. As shown in Fig. 2, individuals with high self-efficacy (level 5) have a 49.6 % probability of rating the Climate Crafts sector as "rather attractive" (Likert scale 4), while those with low self-efficacy (level 1) have only a 38.2 % probability. This indicates a positive impact of self-efficacy on general attractiveness, suggesting that individuals who believe in their capabilities are more likely to find these occupations generally appealing.

The results for H1b show that the effect of self-efficacy on personal attractiveness is even greater in magnitude compared to general

**Table 2**

Results of the ordinal regression analysis suggest that education, self-efficacy beliefs, parental and peer approval, knowledge and green career commitment predict general attractiveness of Climate Crafts.

| Predictors                    | General Attractiveness |            |           |                  |
|-------------------------------|------------------------|------------|-----------|------------------|
|                               | Odds Ratios            | std. Error | Statistic | p                |
| Stimulus environmental impact | 0.93                   | 0.14       | -0.47     | 0.636            |
| Stimulus income expectations  | 1.31                   | 0.19       | 1.83      | 0.067            |
| Stimulus tangible results     | 0.96                   | 0.14       | -0.27     | 0.790            |
| Lower education               | 0.65                   | 0.08       | -3.45     | <b>0.001</b>     |
| Occupational self-efficacy    | 1.30                   | 0.08       | 4.28      | <b>&lt;0.001</b> |
| Parental and peer approval    | 1.33                   | 0.08       | 5.06      | <b>&lt;0.001</b> |
| Knowledge on craft jobs       | 1.38                   | 0.08       | 5.69      | <b>&lt;0.001</b> |
| Green career commitment       | 1.18                   | 0.06       | 3.25      | <b>0.001</b>     |
| Gender = female               | 0.90                   | 0.10       | -0.95     | 0.342            |
| Observations                  | 1280                   |            |           |                  |
| Log-Likelihood                | -1535.131              |            |           |                  |

**Table 3**

Results of the ordinal regression analysis suggest that education, self-efficacy beliefs, parental and peer approval, knowledge, green career commitment, and gender predict the personal attractiveness of Climate Crafts.

| Predictors                    | Personal Attractiveness |            |           |        |
|-------------------------------|-------------------------|------------|-----------|--------|
|                               | Odds Ratios             | std. Error | Statistic | p      |
| (Intercept) × 1               | 0.02                    | 0.01       | -9.22     | <0.001 |
| (Intercept) × 2               | 0.00                    | 0.00       | -14.56    | <0.001 |
| (Intercept) × 3               | 0.00                    | 0.00       | -17.69    | <0.001 |
| (Intercept) × 4               | 0.00                    | 0.00       | -15.09    | <0.001 |
| Stimulus environmental impact | 0.87                    | 0.13       | -0.93     | 0.353  |
| Stimulus income expectations  | 0.90                    | 0.13       | -0.73     | 0.468  |
| Stimulus tangible results     | 1.04                    | 0.15       | 0.29      | 0.775  |
| Lower education               | 1.53                    | 0.19       | 3.42      | 0.001  |
| Occupational self-efficacy    | 2.33                    | 0.15       | 13.01     | <0.001 |
| Parental and peer approval    | 1.58                    | 0.09       | 7.90      | <0.001 |
| Knowledge on craft jobs × 1   | 0.94                    | 0.07       | -0.83     | 0.408  |
| Knowledge on craft jobs × 2   | 1.07                    | 0.07       | 0.91      | 0.360  |
| Knowledge on craft jobs × 3   | 1.28                    | 0.11       | 2.96      | 0.003  |
| Knowledge on craft jobs × 4   | 1.48                    | 0.22       | 2.71      | 0.007  |
| Green career commitment       | 1.68                    | 0.09       | 10.07     | <0.001 |
| Gender = female × 1           | 0.61                    | 0.10       | -2.88     | 0.004  |
| Gender = female × 2           | 0.45                    | 0.06       | -5.72     | <0.001 |
| Gender = female × 3           | 0.52                    | 0.08       | -4.15     | <0.001 |
| Gender = female × 4           | 0.87                    | 0.22       | -0.57     | 0.570  |
| Observations                  | 1280                    |            |           |        |
| Log-Likelihood                | -1614.495               |            |           |        |

attractiveness. The odds ratio for self-efficacy is 2.33 ( $p < 0.001$ ,  $SE = 0.15$ ), meaning that for each one-unit increase in self-efficacy, the odds of perceiving the crafts sector as personally attractive increase by 133%. This suggests that self-efficacy has a substantial impact on personal interest in these occupations. The predicted probabilities illustrate the extent of this effect, particularly for the extreme categories of attractiveness. As shown in Fig. 3, individuals with low self-efficacy have a 64.9% probability of finding Climate Craft jobs not personally attractive, whereas those with high self-efficacy have only a 5.1% probability of reporting no personal attractiveness. This stark difference highlights the powerful role of self-efficacy: higher levels significantly reduce the

likelihood of finding these jobs unappealing and instead increase their attractiveness on a personal level.

5.2. Outcome expectations: Parental and peer approval

Hypothesis H2a posits that the greater the perceived approval of parents and peers regarding vocational education and training (VET) in the skilled trades, the higher the general attractiveness of Climate Craft occupations. The results support this hypothesis with an odds ratio of 1.33 ( $p < 0.001$ ,  $SE = 0.15$ ). This indicates that for each one-unit increase in the perceived approval from parents and peers, the odds of finding Climate Crafts generally more attractive increase by 33%, holding all other variables constant. The predicted probabilities further illustrate this effect. The highest possible approval from parents and peers results in a 21.9% probability of rating Climate Craft jobs as very appealing, whereas the lowest possible approval results in only an 8.2% probability of rating the sector as very appealing (see Fig. 4). Additionally, adolescents who assume low approval are more likely to rate the occupation neutrally, suggesting that a perceived lack of support from parents and peers is associated with more reserved attitudes toward these jobs.

We observed similar patterns for personal attractiveness. For each one-unit increase in perceived parental and peer approval, the odds of finding Climate Crafts personally attractive increase by 53%, holding all other factors constant. Expressed in predicted probabilities, Fig. 5 shows that individuals who perceive no approval from parents and peers have a 44.9% probability of finding Climate Craft jobs not personally interesting, while those perceiving high approval have only an 11.4% likelihood of finding the sector unattractive. Furthermore, those with great perceived disapproval from peers and parents have only a 3.11% likelihood of finding the sector personally attractive, whereas this likelihood increases to 25.6% for adolescents who anticipate strong approval.

5.3. Message framing: Environmental impact, tangible results, and income

The analysis of framing effects on the perceived attractiveness of Climate Craft occupations among adolescents revealed mixed results.

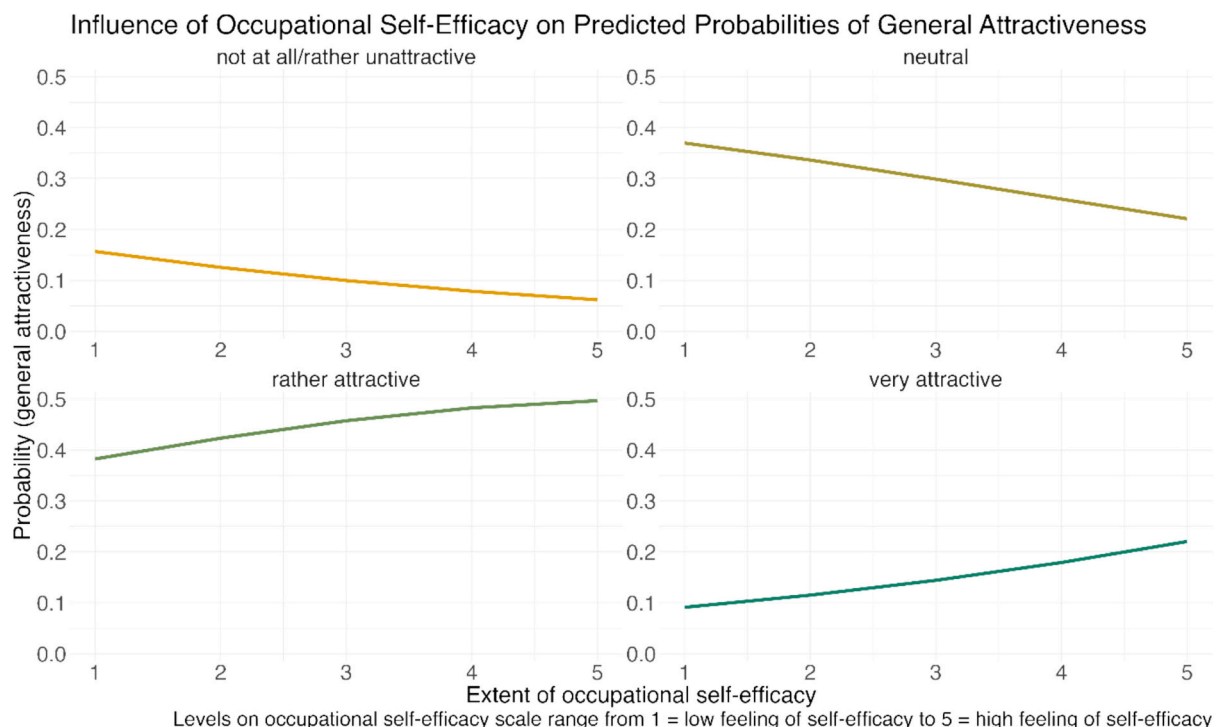


Fig. 2. Higher levels of self-efficacy are associated with greater perceived general attractiveness of trades.

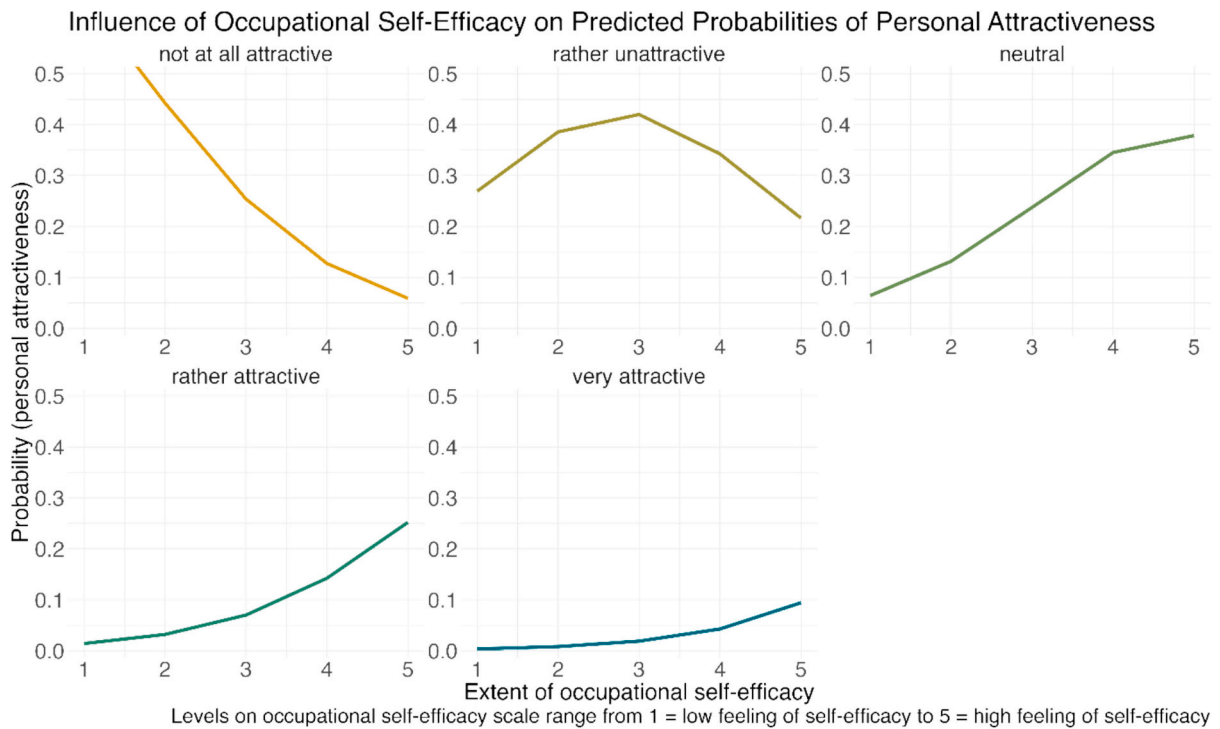


Fig. 3. Low self-efficacy beliefs significantly increase the likelihood of rating the personal attractiveness of Climate Crafts jobs as “not at all attractive”.

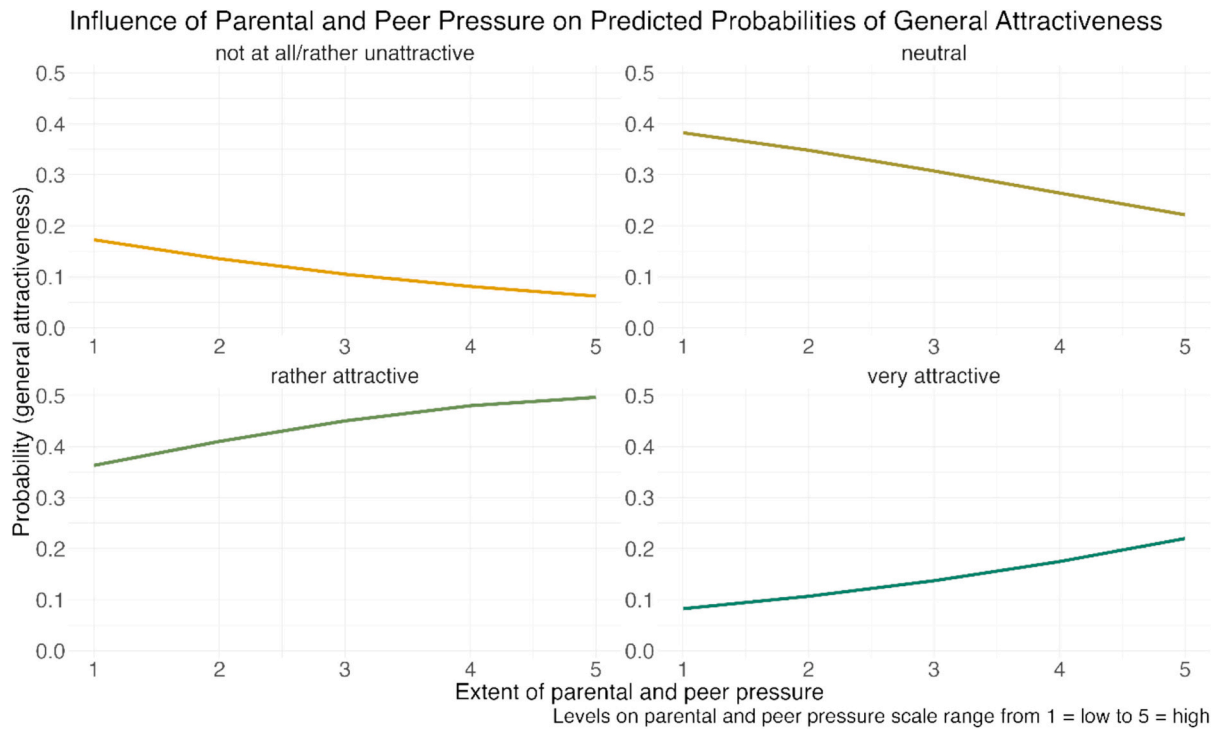


Fig. 4. Higher perceived approval from parents and peers increases the likelihood of finding Climate Craft occupations generally appealing, while lower approval is associated with more neutral or unattractive ratings.

There was no support for Hypotheses H3a, H3b, H4a, and H4b, which predicted that emphasising the positive effect of craft jobs on climate change mitigation or the tangible results would increase the general and personal attractiveness of these occupations.

In contrast, Hypothesis H5a, which proposed that emphasising income and career opportunities would increase general attractiveness,

received some support. The odds ratio for income framing was significant at the 10 % level (odds ratio of 1.31,  $p = 0.67$ ,  $SE = 0.19$ ). This indicates that highlighting financial benefits and career prospects can have a modest positive impact on the perceived general attractiveness of these occupations. We did not find an effect of income framing on personal attractiveness (H5b).

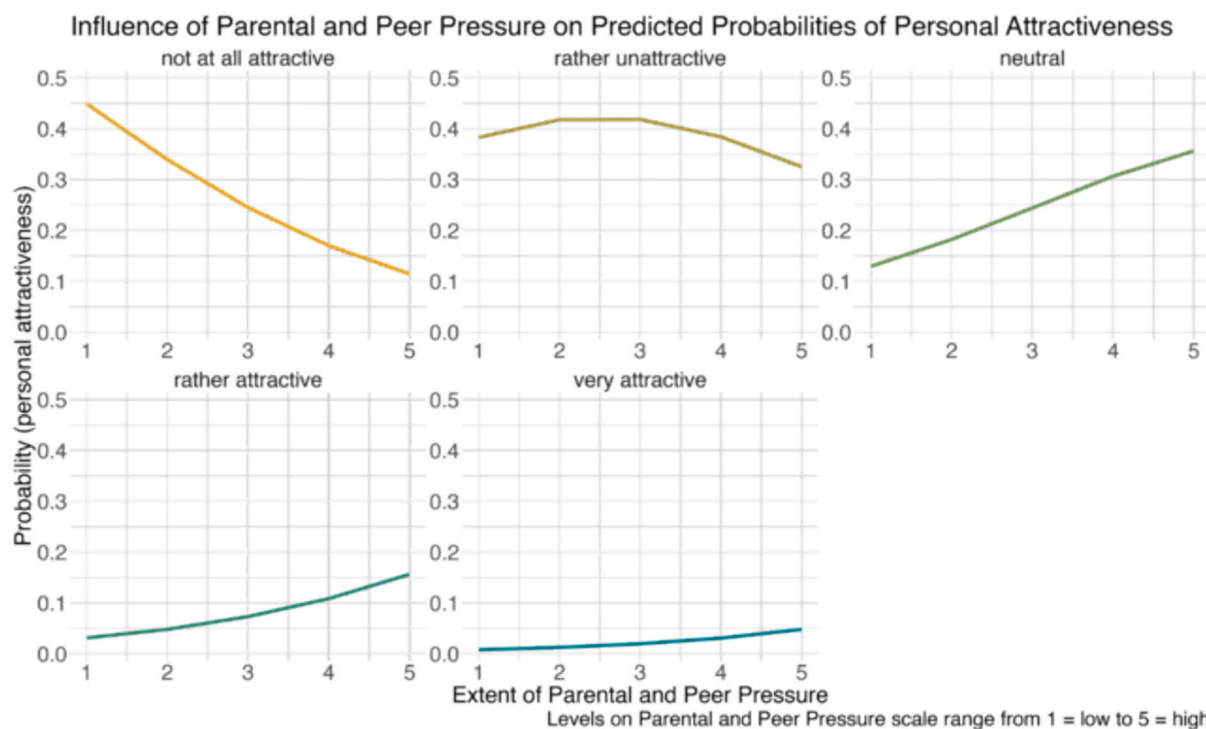


Fig. 5. Higher perceived approval from parents and peers significantly increases the likelihood of finding Climate Craft occupations personally attractive, while low approval is linked to greater unattractiveness.

#### 5.4. Controls

Interestingly, education was distinctly related to general versus personal attractiveness. For general attractiveness, individuals with higher education are more likely to rate Climate Crafts positively compared to those with lower education. Specifically, individuals with higher education have a 17.0 % probability of rating climate crafts as “very attractive”, compared to only 11.7 % for those with lower education. In contrast, higher education is associated with lower ratings for personal attractiveness. Individuals with higher education have a 31.2 % probability of rating Climate Crafts as “rather personally unattractive”, compared to 25.1 % for those with lower education. This indicates that individuals evaluate the general and personal attractiveness of vocational Climate Crafts differently depending on their educational background.

Green career commitment significantly predicted both general and personal attractiveness. For general attractiveness, individuals with a strong desire to contribute to environmental protection are more likely to view climate crafts favourably. For example, a respondent who rates their environmental goal as very high has a 21.2 % probability of finding climate crafts generally “very attractive”, compared to 12.3 % for someone with a rating of 1 (lowest). We also observed this effect for personal attractiveness, where individuals with high green career commitment had a 22.5 % probability of rating climate crafts as personally “attractive”, while those with the lowest rating had only a 4.1 % probability of doing so.

Moreover, knowledge about the Climate Crafts was an important predictor of attractiveness. For general attractiveness, an individual with high knowledge (rating = 5) had a 22.4 % probability of rating the sector generally “very attractive”, compared to only 7.4 % for someone with low knowledge (rating = 1). For personal attractiveness, the results suggest that knowledge about craft jobs plays a significant role at higher levels of the scale. For those who rate craft jobs as moderately to highly attractive, increased knowledge is associated with more positive perceptions. For instance, respondents who think they know a lot about these jobs are 5.9 % more likely to rate craft jobs as personally more

attractive. However, at lower levels of attractiveness, knowledge does not seem to make a difference.

Although there is no significant effect of gender on general attractiveness, gender has a significant effect at the lower levels of personal attractiveness. Female participants have a 88.5 % probability of rating personal attractiveness of craft-jobs as either not attractive at all, not attractive or neutral. In contrast, their male counterparts only have a 80.5 % probability to do so. However, this significant difference diminished at the higher levels of attractiveness.

## 6. Discussion

Our results substantially advance the scientific understanding of the attractiveness assessment of Climate Crafts among adolescents and bear important implications for further research and practice.

### 6.1. Result 1: Lack of craft-related self-efficacy is a crucial impediment to entering the climate crafts

Consistent with Social Cognitive Career Theory and previous studies (e.g. 63), our results underscore the significant role of self-efficacy in shaping the attractiveness of Climate Craft occupations among adolescents. Individuals with high self-efficacy are more likely to perceive these occupations as appealing, which indicates that believing in one’s abilities enhances both the general and personal attractiveness of the crafts sector. The effect is particularly pronounced for personal attractiveness, suggesting that self-efficacy not only affects general perceptions but is crucial when individuals contemplate pursuing a career in this field.<sup>6</sup> Thereby, our results extend SCCT’s applicability to the skilled trades – a domain traditionally underexplored in this context [59,75].

The observation hints at an increasing disconnect from manual work

<sup>6</sup> This pronounced effect of self-efficacy on personal attractiveness is plausible since a person might perceive Climate Crafts as generally attractive but low degrees of self-efficacy might diminish her personal interest.

due to the growing academisation of society as discussed in section 2.2. As 55 % of participants in the exploratory section expressed doubts about handling physically demanding tasks, fostering craft-related self-efficacy appears crucial for enhancing the attractiveness of Climate Craft careers. (Re-)incorporating handicrafts and technical work into school curricula could be an effective strategy to nourish craft-related self-efficacy from early childhood on. Offering internships and opportunities to try-out manual work in the skilled crafts and trades could further increase self-efficacy beliefs specifically related to respective trades, such as the here studied Climate Crafts.

### 6.2. Result 2: The low reputation of climate crafts and VET among parents and peers deters large segments of youth from such occupations

In line with previous research on social influences in vocational decision-making, the results further confirm that parental and peer approval significantly influence the perceived general and personal attractiveness of Climate Craft occupations. In our study, greater perceived approval from parents and peers was associated with more favourable perceptions of these careers, particularly in terms of personal attractiveness.

This indicates the existence of educational ‘path-dependencies’ leading to a social disconnect or ‘silo formation’ between academically and vocationally trained population segments. Therefore, our findings reiterate on Smith’s [9] call to expand campaigns and messaging beyond the potential applicants, particularly to their parents.

### 6.3. Result 3: Highlighting income opportunities is most effective in increasing the attractiveness

The analysis of framing effects on the perceived attractiveness of Climate Craft occupations yielded ambivalent insights. While emphasising the positive *environmental impact* and *tangible results* did not significantly influence attractiveness perceptions, highlighting *income and career opportunities* increased the general attractiveness of these occupations, with statistical significance at the 10 % level. However, this effect did not extend to personal attractiveness. Yet, these results should be interpreted cautiously since a single exposure to a stimulus is expected to only yield small effects [76].

Following the indications of these findings, financial incentives may play a more immediate role in shaping general perceptions of Climate Craft careers among adolescents. This aligns with the Social Cognitive Career Theory and previous findings [47,48,53] that particularly monetary outcome expectations can influence career interests when they resonate with personal values. The prominence of income as a motivating factor among adolescents is evident in the study’s experimental analysis, where 86 % of participants rated income as either very important or important for a future job. This preference may explain the effect of income on general attractiveness. One reason why the effect does not extend to personal attractiveness could be that the latter is more directly linked to actual behaviour and decision-making. As mentioned earlier, personal career choices are likely influenced by deeper, more ingrained structural factors that go beyond the information presented in the stimuli. Therefore, these underlying considerations may have diminished the impact of a one-time exposure to the stimulus for personal attractiveness.

In contrast, the specific aspects emphasised in the *tangible results* and *environmental impact* stimuli may not align closely with the participants’ personal occupational goals. Smith [9] argues that the same attributes constitute attracting and deterring factors for different groups. Highlighting the manual hands-on nature of the Climate Crafts in the *tangible results* framing could, thus, have been deterring to a sample with low manual self-efficacy (see above), even if the stimulus was framed to highlight purpose and fulfilment through producing *tangible results*. Moreover, previous research suggests that the appreciation of this aspect may become more prominent at later career stages when the *lack of*

*tangible results* becomes a frustrating factor for many professionals [63]. Thus, this framing might be ill-suited for adolescents without professional experience. As for *environmental impact*, the stimulus yielded no significant effect but *green career commitment* as a control variable and individual factor had a significant effect on general and personal attractiveness. This indicates that individuals with a job goal to combat climate change are indeed more likely to assess Climate Crafts as attractive but the subordinate importance of this goal in the entire sample resulted in no significant overall effect. Additionally, highlighting *environmental impact* might have prompted reactant behaviour among participants with resentments to green topics who thus potentially indicated a lower attractiveness. Overall, these findings highlight that although pro-environmental attitudes may be more common in the Generation Z than in previous generations, generalisations across cohorts are overly simplistic. Additionally, pro-environmental attitudes do not necessarily translate into a widely increased willingness to take on climate-related craft jobs given the limited salience of work as role for environmental action and sector-specific characteristics that are deterring to part of the youth [63]. These emerging aspects could be explored in future research with larger samples and are beyond the scope and statistical power of this paper and sample.

Lastly, findings on messaging effects could also indicate awareness and knowledge levels about these attributes among adolescents. As revealed in section 2.2, knowledge about the skilled trades is low in ‘distanced’ groups. In contrast, for example, to the idea of *tangible results*, the over-average earning opportunities in the skilled trades might have been particularly surprising to the participants, thus, resulting in the largest effect on attractiveness. This proposition is consistent with public perceptions in Germany where “*seeing the results of your work every day*” is the job characteristic most commonly associated with craftwork compared to jobs with a completed university degree (77 % of the 1500 respondents in a representative survey of German inhabitants from 2021) while “good earning opportunities” is least associated with craftwork (7 % of respondents) [43]. Future research could construct stimuli differently and test stimuli on other aspects of Climate Crafts with larger samples to provide a more nuanced understanding of how different framings resonate with different demographics.

### 6.4. Result 4: Knowledge, education, and gender influence the attractiveness assessment of climate crafts

In addition to the investigation of our hypotheses (results 1–3), the ordinal logistic regressions revealed important insights for our controls. Consistent with previous research as reviewed in section 2.2, gender, knowledge, and education affect attractiveness assessments significantly.

For gender, we find that women are indeed more likely than men to perceive Climate Crafts as personally unattractive. This signifies the need for tailored approaches to attract women as ‘unlikely’ target groups into the Climate Crafts.

For knowledge, the results suggest a positive relationship between knowledge about the skilled trades and their perceived attractiveness. This corroborates our previous conclusion that the disconnect from manual work and VET in the skilled trades leads to path-dependencies and silo formation. Hence, informing about those occupations and facilitating contact and ‘social mixing’ with tradespeople for ‘distanced’ or ‘unlikely’ groups likely is crucial to mitigate recruitment problems in the Climate Crafts.

For education, the results show a divergence between personal and general attractiveness, depending on education levels. Put simply, individuals with high education perceive Climate Crafts as *generally* attractive, but not for themselves *personally* – and vice versa for individuals with low education. This suggests that the general reputation and prestige of the Climate Crafts in Germany are high among highly educated people – but the individual personal job fit (influenced, for example, by personal interests, self-efficacy, or outcome expectations) is

low. In other words, ‘crafts are great, but not for me’. This finding also corresponds to general trends in Germany where craftspeople rank among the five most reputable occupations [77] and 87 %, respectively 93 %, of the population consider the skilled crafts as generally and personally (very) important [43]. Thus, ‘unlikely’ groups might value aspects of craftwork such as that “*craftspeople are needed, are indispensable, are important for people*” [43] but have reservations that prevent the translation to personal attractiveness. Moreover, despite the appreciation of craftspeople’s importance, only 36 % of the population think that their social prestige is high [43]. The divergence between the individual valuation and the beliefs about what view is prevalent in the population is known in social psychology as ‘pluralistic ignorance’ (e.g. [78]). The finding concerning education, thus, has two main implications. First, increasing the perceived job fit of Climate Crafts could lift personal attractiveness more to the level of general attractiveness for highly educated people. Second, more clearly communicating the social norm (‘skilled crafts are reputable and important’), particularly through trusted actors outside the sector, could be conducive to counteract pluralistic ignorance.

### 6.5. Limitations

Our results should be interpreted in the light of several limitations.

First, our sample is neither representative of the initial target population (Germans between 16 and 23 with or aspiring to university entrance qualifications) nor of the age cohort. Our findings, thus, primarily refer to effects within our sample and only provide indications of potential effects beyond. However, our careful statistical approach accounts for confounding factors such as unequal distribution of educational backgrounds between the genders. Second, our sample size allowed only for the inclusion of a limited number of control variables which we selected based on theoretical considerations and the literature review. Other background variables such as rural/urban residence or migratory background could be included as controls in future studies. Third, the results of the experimental stimuli should not be over-interpreted given that a single exposure is known to yield only small effects [76]. Fourth, the construction of the *tangible results* framing might have evoked ambivalent and conflicting effects because it combined an explication of the manual hands-on nature of the Climate Crafts with their tangible results benefitting society. Fifth, comparing the income in the Climate Crafts to the median wage in Germany might be ill-suited for our sample since participants with or aspiring to university entrance qualifications might have even higher income expectations for pursuing ‘white collar’ careers. Thus, highlighting that income opportunities in the Climate Crafts are comparable to or even higher than in many academic professions might be more appropriate for addressing this target group and should be tested in future research. Sixth, following standard survey procedure, peer approval and self-efficacy were elicited before the stimuli informed about the ‘Trades of the Future’ to avoid stimulus effects on predictors. Hence, participants’ responses were based on the broader definition of skilled crafts and trades provided at the beginning of the survey. This reduces their expressiveness for the specific Climate Crafts. However, the skilled crafts sector in Germany is publicly perceived as an overarching sector of similar occupations with similar requirements [33]. Thus, we believe the predictors are sufficiently good approximations also for the studied Climate Crafts. Seventh, Germany constitutes a special case for its dual education approach to VET and the formalisation of apprenticeships.

Acknowledging the limiting nature of these elements, we consider this study to be a robust and valuable starting point for future research. Subsequent studies should examine the here-found relationships with larger and more representative samples, test the effect of different framings, and explore the attractiveness of Climate Crafts in different geographies beyond Germany.

## 7. Conclusion

This study represents an unprecedented investigation of a crucial yet under-recognised bottleneck for realising sustainability transitions: attracting young people into the skilled crafts and trades (Climate Crafts) to implement transitions on-the-ground.

Inaugurating the skilled crafts and trades as a new application field for Social Cognitive Career Theory, we explore determinants for job attractiveness of these Climate Crafts through an original online survey among German adolescents. The results of ordinal logistic regression models reveal that low degrees of craft-related self-efficacy, perceived approval from parents and peers, and knowledge about the skilled crafts and trades constitute the main impediments to entering an apprenticeship in the Climate Crafts. Moreover, the sector still constitutes an unattractive field for women and highly educated groups. Particularly the latter tend to perceive Climate Crafts as generally attractive but personally ill-fitted occupations – ‘crafts are great, but not for me’. Highlighting income opportunities could be most effective to increase application numbers but risks drop-outs given the limited earnings during apprenticeships.

Our findings provide crucial insights for practice and policymaking. First, the alleged disconnect between manual labour and VET in academised societies manifests in this study through low degrees of knowledge, craft-related self-efficacy, and educational path-dependencies in families. Increasing practical learning in schools and internships and facilitating social mixing between the silos of academically and vocationally trained population segments could foster a re-connection to the skilled crafts and trades. Second, raising awareness about different and surprising aspects of the Climate Crafts could increase their attractiveness among ‘unlikely’ groups. Yet, messaging also needs to engage with the unique concerns of specific groups, such as women, to expand the target groups beyond the ‘likely’. Third, particularly trusted and influential actors from outside the sector are called upon to communicate the social norm and recognition of craft occupations to counteract pluralistic ignorance. Increasing social recognition of craft services could also contribute to raising general willingness to pay for these services, and, ultimately, lead to rises in salary – a primary motivator for occupational choices. Fourth, craft actors also ‘need to deliver’. Image campaigns [22] discrediting academic education might appeal to vocational peers but are unlikely to speak to academically socialised groups. Highlighting apprenticeships and craftwork as attractive career paths also requires adapting these paths to the preferences of the current adolescent generation. There is just one youth and in a workers’ market, employers need to prove their eligibility to potential employees. The unpopularity of apprenticeships and careers in the skilled crafts and trades among adolescents can only partly be attributed to adolescents’ lack of knowledge and is also associated with existing deficiencies in the trades. Lastly and correspondingly, policymakers are challenged to equip the vocational training system with similar resources as academic education. Acknowledging the importance of practical knowledge and skills is key to realising sustainability transitions.

### CRedit authorship contribution statement

**Myriam Aichinger:** Writing – original draft, Visualization, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Simon Wehden:** Writing – original draft, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Jonas Ludwig:** Writing – review & editing, Software, Methodology, Formal analysis, Data curation. **Felix Creutzig:** Writing – review & editing, Supervision, Funding acquisition.

## Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used *DeepL* in order to translate survey questions and stimuli in German language into English. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Simon Wehden reports financial support was provided by Heinrich Boll Foundation. Myriam Aichinger reports financial support was provided by Heinrich Boll Foundation. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Data availability

Data and code are included in the online Supplementary Material, the link of which is provided in section 4.

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