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Understanding the reasons why career changers pursue or pass on a STEM teaching career: a Best–Worst Scaling (BWS) approach

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Abstract
Intractable shortages of science, technology, engineering, and mathematics (STEM) teachers have prompted international policy efforts to recruit career changers to the profession. This research determines the significant influences on career changers' decisions to pursue or pass on STEM teaching careers. Surveys completed by 91 career changers from Queensland, Australia, were analysed with Best–Worst Scaling (BWS) methods and Margaret Archer's theories of reflexivity to establish the relative importance of factors influencing career changers' deliberations on a STEM teaching career. The social impact of teaching was the most influential factor for career changers considering STEM teaching. Career changers who pursued the profession were also influenced by past teaching experiences and feelings towards STEM subjects. Conversely, career changers who decided against STEM teaching indicated their personal traits and life circumstances might not suit a teaching career. These findings offer implications for research and policy aimed at recruiting career changers into STEM teaching careers.

Keywords STEM · Teacher shortage · Best–Worst Scaling · Career change · Motivation

Introduction

To ensure a national STEM-skilled workforce able to meet emerging economic and social challenges, it is timely to understand what influences individuals to choose science, technology, engineering, and mathematics (STEM) professions, including

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as STEM teachers. Given the importance of STEM teachers for student engagement and pathways into STEM-skilled careers (Timms et al., 2018), shortages of such teachers are a pressing concern. Teacher shortages have recently generated (inter) national policy to attract priority groups, including career changers, into the profession. However, there is a lack of understanding about the relative importance of factors influencing career changers' decisions to either 'pursue or pass' on a STEM teaching career. This research addresses a gap in current scholarship by answering the question: What are the most important reasons influencing career changers' decisions to pursue or pass on a STEM teaching career?

This paper unfolds in six sections. The first section outlines the drive for a STEM-skilled workforce as well as policy responses for increasing recruitment of STEM teachers, especially those termed 'career changers'. Next, we summarise literature on what influences career changers to choose STEM teaching careers. Third, we describe Margaret Archer's theories of reflexivity used to explore career changers' decision-making in this research (Archer, 2007). Next, the Best–Worst Scaling (BWS) methodology is explained, including the instrumentation, data collection, participants, and data analysis. The fifth section presents the research findings and compares the reasons that career changers pursue or pass on STEM teaching. Finally, we suggest recommendations for research and policy to better support career changers into STEM teaching careers.

Background context

Globalisation and the rise of technological innovation have increased demand for workers with advanced technical and problem-solving capabilities. Research suggests that 75% of the fastest-growing occupations require significant STEM skills (Department of Education & Training, 2021) and that a STEM-skilled workforce supports national productivity and economic wellbeing (Office of the Chief Scientist, 2020). STEM skills are needed to address emerging social and environmental challenges including climate change, global healthcare concerns, food security, renewable energies, and resource management (Kelley & Knowles, 2016). These issues highlight the importance of STEM education and the educators needed to guide students through schooling and into STEM careers. With STEM teacher shortages impacting many countries, there has been concerted international attempts to recruit STEM teachers into the profession.

International efforts to address shortages and recruit STEM teachers have taken varied approaches. For example, in the United Kingdom, the *Teacher Recruitment and Retention Strategy* has posited streamlined application pathways, bursaries for maths, science, and technology pre-service teachers, and loan reimbursement for science in-service teachers at challenging schools (UK Department for Education, 2019). Sign-on bonuses and acclimatisation packages are also offered to incentivise internationally qualified STEM teachers to teach in the United Kingdom. (UK Department for Education, 2018). The United States government has taken a different approach, with the Obama-Biden administration enacting a national *STEM Teacher Pathways* (*100kin10*) initiative (Stevenson, 2014). This

programme supports STEM teacher recruitment through research funds, grant allocations, and a campaign to dispel teaching misconceptions held by tertiary providers and STEM majors (Stevenson, 2014).

Australia is similarly facing shortages of qualified mathematics and science teachers (Department of Education, 2022; see also Dadvand et al., 2023). STEM teacher shortages are widespread; for example, in a recent national survey of independent school principals, 67% reported maths teacher shortages, 55% reported physics teacher shortages, and 42% reported technology teacher shortages (New South Wales Government, 2023). These shortages are compounded by high rates of 'out-of-field' teaching, where teachers teach outside of their specialisation area (Hobbs & Törner, 2019). Estimates suggest 40% of mathematics teachers and 29% of science teachers are teaching out-of-field nationally (Department of Education, 2022). Shortages and out-of-field teaching may impact the quality of education students receive (du Plessis, 2015) and can affect engagement and retention in STEM subjects (Timms et al., 2018). In turn, this can restrict the flow of the STEM 'pipeline' into the national workforce, resulting in fewer new STEM teachers and amplifying existing shortages.

In responding to teacher shortages, the 2022 *National Teacher Workforce Action Plan* identifies the recruitment of STEM teachers as a priority. Initiatives to recruit STEM teachers mirror international efforts, including study bursaries and stipends for pre-service teachers undertaking STEM teaching area professional placements in regional schools (Department of Education, 2022). In addition, several state-level programmes recruit career changers with STEM industry backgrounds to teach. New South Wales's *Mid-Career Transition to Teaching* programme offers study bursaries, mentoring, and a financial bonus to support STEM industry career changers to complete a teaching degree (Department of Education, 2022). Queensland's *Turn to Teaching* internship similarly incentivises career changers who may have STEM expertise through scholarships and paid internships (Department of Education, 2023a). Although scholars have questioned the use of financial incentives to attract teaching candidates (e.g., Munthe & See, 2022), these recruitment programmes reflect growing recognition that career changers have the potential to be part of the solution to national STEM teacher shortages.

In this study, career changers are defined as individuals over 21 who do not enter ITE directly from secondary schooling pathways (Siostrom et al., 2023). This inclusive definition enabled the researchers to examine factors influencing career changers from a diverse range of backgrounds and experiences, including those with prior STEM-related experiences. In Australia, career changers comprise more than a third of ITE entrants (Australian Institute of Teaching and School Leadership, 2019) and bring significant career and life experiences to teaching careers. They are positioned as 'game changers' for their diverse expertise, knowledge, and specialist competencies (Varadharajan & Buchanan, 2021). Given the potential of career changers to ease STEM teacher shortages, an understanding of what underlies their decision-making to pursue or pass on a STEM teaching career is critical.

Literature

Despite a boom in research on career change teachers, there is a paucity of literature focused specifically on those who consider careers as STEM teachers (Siostrom et al., 2023). Studies that are STEM-related primarily explore the motivations and experiences of mid-career professionals transitioning from an industry career (e.g., doctor, engineer) into science or mathematics teaching (e.g., Grier & Johnston, 2009, 2012; Smetana & Kushki, 2021). The motivations of STEM industry career change teachers generally align with those of career change teachers more broadly (Varadharajan & Buchanan, 2021). Research indicates that career changers are influenced by the social importance of teaching (Smetana & Kushki, 2021), prior teaching experiences (Grier & Johnston, 2009, 2012), personal events (Snyder et al., 2013), career dissatisfaction (Watters & Diezmann, 2015), lifestyle considerations, and the salary and conditions of teaching (Richardson & Watt, 2005).

However, there are differences in motivations between STEM industry career change teachers and career change teachers in general. A chance to teach within a preferred discipline (e.g., mathematics or biology) was a prominent motivator for career changers from STEM industry backgrounds (Grier & Johnston, 2012; Watters & Diezmann, 2015). This mirrors research findings regarding the motivations of traditional-entry STEM teachers (Whiteford et al., 2021). Career changers from STEM industry backgrounds also felt equipped to share real-world industry expertise with their students (Varadharajan & Buchanan, 2021). Some career changers with STEM industry backgrounds chose teaching because they believed that their advanced qualifications and experiences would afford them desirable teaching positions in private metropolitan schools (Whannell & Allen, 2014).

In general, the literature about career changers' STEM teaching decisions explores their motivations *to* teach rather than focusing on what deters them from teaching as a career. Studies that do investigate deterrents suggest that career changers with STEM industry backgrounds struggle to transition their professional identity (e.g., scientist or engineer) to that of 'just' a teacher (Smetana & Kushki, 2021; Whannell & Allen, 2014, p. 89) due to a perceived decline in status. Some career changers are discouraged by friends and family that express deficit views of teaching in comparison with a prior STEM industry career (Snyder et al., 2013). Whannell and Allen's (2014) study revealed that career changers with doctoral qualifications were deterred from teaching by salary structures that did not recognise advanced discipline qualifications.

Methodologically, much of the existing research uses qualitative approaches and small samples to explore influences on STEM career change teachers' decision-making. Few studies assess career changers' teaching motivations using quantitative methods. Exceptions include Richardson and Watt's (2005) exploratory factor analysis survey approach that revealed career fit, prior considerations, family time, salary, and social status as factors relevant to 74 career changers' teaching decisions. Bunn and Wake (2015) employed a weighted ranking approach to conclude that 87% of the 346 career changers surveyed were motivated to

teach to make a difference. Finally, Varadharajan et al. (2020) Likert-scale survey ($n = 504$) identified job satisfaction (94%) and traits to teach (94%) as prominent motivators. However, no studies have identified the relative importance of factors influencing career changers' decisions to choose or reject STEM teaching careers. This is significant because it is unclear what policy responses and practices ought to be prioritised, especially in universities and schools with limited funding/resources. Given the difficult task of recruiting career changers to STEM teaching, there is a pressing need to better understand the factors that matter most in their decision-making. This study provides timely insight by establishing the relative importance of factors influencing STEM teaching decisions. It also offers recommendations to support this valuable cohort to enter the profession.

Theoretical background

Margaret Archer's theories of reflexivity (2007) guide this research. Archer defines 'reflexivity' as the mechanism of action individuals use 'to consider themselves in relation to their (social) contexts and vice versa' (2007, p. 4). When contemplating a career in teaching, for example, reflexivity explains how career changers weigh up subjective internal concerns (like prior experiences, beliefs, skills, and values) and objective external circumstances (like job conditions, support structures, and cultural attitudes) to decide upon a course of action. Reflexivity is enacted through internal conversations, including processes like self-talk, planning, imagining, questioning, and anticipating outcomes (Archer, 2007). According to Archer (2007), reflexivity progresses through three phases, often referred to as the 3Ds—discernment (identification of a priority or concern), deliberation (reflexively weighing up internal and external influences), and dedication (choosing a course of action, endorsing priorities, and subjugating others). Our study recruited career changers who discerned STEM teaching as a possible career and aimed to illuminate the reflexive deliberations that they navigated to make their STEM teaching decision.

During deliberation, individuals explore the implications of endorsing priorities or concerns. This involves weighing up personal, structural, and cultural conditions that emerge as either enablements or constraints during the decision-making process (Archer, 2007). Earlier work from the authors (see Siostrom et al., 2023) mapped the literature on career changers' teaching motivations to Archer's categorisation of emergent properties (EPs) as personal (PEPs), structural (SEPs), or cultural (CEPs) in nature. This summary identified conditions including knowledge of the profession (PEP), time, and career conditions (SEPs) that enabled the decision to teach, as well as conditions like money (SEP) and the societal value of teaching (CEP) that could enable or constrain in different contexts (Siostrom et al., 2023). The factors incorporated in this scale instrument (elaborated below) are similarly aligned; for example, traits are personal, the schedule of teaching is structural, and social views of teaching are cultural properties that may emerge to enable or constrain.

Though individuals deliberate in different ways, the methodology (explained next) was chosen for its capacity to determine the relative importance of EPs that influence career changers' deliberations regarding STEM teaching careers. This

approach enables a 'deep dive' into what matters most to career changers considering a teaching pathway. Our analysis compares the reasoning of career changers who dedicated themselves to STEM teaching versus the reasoning of career changers who decided against teaching. Archer's theorisations of reflexivity offer a robust theoretical frame for understanding the reasons underlying career changers' STEM teaching decisions.

Methodology

This study uses the Best–Worst Scaling (BWS) approach (Finn & Louviere, 1992) to determine the factors that a sample of Queensland career changers considered most important when reflexively deliberating on a STEM teaching career. The approach organises and presents influential factors into question sets, and respondents are tasked with selecting the most important and least important factor from each set (Louviere et al., 2015). The factors were generated from a literature review and focus group interviews with career changers, the details of which are elaborated in the next section. The BWS approach assigns a value of mean relative importance (BWS score) to each factor; these are collated to compare the factor rankings of career changers who chose to pursue teaching with the rankings of those who decided against STEM teaching.

The past decade has seen emerging use of the BWS methodology to explore decision-making in educational contexts. In 2013, Burke and colleagues used BWS to identify key factors influencing early career teachers' decisions to remain in the profession, identifying student engagement, professional challenges, and support of colleagues as key factors (Burke et al., 2013). Other studies have since used BWS to explore secondary students' subject preferences (Palmer et al., 2017), teachers' concerns regarding interactive whiteboard use (Burke et al., 2018), and preferences for professional development among pre-service and in-service teachers (Burke et al., 2022). This paper presents the first use of the BWS methodology to understand career change teachers' decision-making.

The BWS approach was selected in preference to a Likert-style instrument. Likert scales have been criticised for response biases that reduce differentiation, including reluctance to use scale extremes (Weijters et al., 2010) or respondents scaling multiple factors as equally important (Burton et al., 2019). Respondents also face challenges in responding consistently across the survey duration (Kiritchenko & Mohammad, 2017). The BWS method addresses these issues with an approach based on random utility theory (Louviere et al., 2015), a model that explains how individuals evaluate factors within a list. Instead of ranking factors against a common scale, BWS respondents rank factors against one another to discriminate importance. The BWS methodology illuminates the real-world processes of reflexive decision-making (Archer, 2007), as individuals weigh up or 'trade-off' factors against one another, rather than weighing up all factors against an arbitrary scale (as in Likert-style approaches). Compared with Likert-style scales, the BWS methodology demonstrates better factor discrimination (Heo et al., 2022) and test–retest reliability (Burton et al., 2019), reduces cognitive burden (Louviere et al., 2015), and better

predicts individual preferences (Burton et al., 2019). Most importantly, it answers our research question by determining the relative importance of factors that influence the decision-making of career changers to pursue or pass on a STEM teaching career.

Instrumentation and data collection

Data were collected using a BWS scale. The scale factors generated for this survey were synthesised from earlier research phases including a scoping literature review (Siostrom et al., 2023) and semi-structured focus group interviews with 12 career changers (from the same population, independent of the present study) who had recently decided for or against STEM teaching careers (Siostrom, 2023). The literature and interview findings were inductively coded using thematic analysis (Braun & Clarke, 2006), before being deductively categorised according to Archer's emergent properties. Findings from both studies were combined using a modified triangulation approach (Farmer et al., 2006) to generate 21 evidence-informed factors that influenced the decision-making of career changers considering STEM teaching

Table 1 Factors that influence career changers' decision-making about STEM teaching careers

Factor	Statement	EP
1	Past teaching experiences (e.g. tutoring, staff training, parenting)	PEP
2	My traits (e.g. intelligence, patience)	
3	Influence of past teachers, friends or family who teach	
4	My feelings about young people	
5	How I think students will behave	
6	My feelings about STEM areas (e.g. like or dislike science)	
7	Comparing teaching to other careers	
8	The schedule (e.g. daily hours, holidays)	SEP
9	The salary	
10	The workload	
11	Financial costs of becoming a teacher	
12	The study (e.g. time required, course demands)	
13	Resources available to me (e.g. childcare, financial support)	
14	World events (e.g. pandemic, recession, industry changes)	
15	How society views/treats teachers	CEP
16	Media or social media about teachers/students	
17	The impact teaching has on society	Crossover EPs
18	How well teaching would suit my life	
19	The expectations on teachers	
20	How my friends and family view teaching	
21	I prefer STEM teaching or STEM industry (e.g. being a scientist vs science teacher)	

careers (Table 1). These factors have been categorised as PEPs, SEPs, CEPs, or those that crossover between categories.

The above factors may have influenced career changers in a way that enabled *or* constrained the potential of a STEM teaching career, depending on individual context (Archer, 2007). For example, personal traits were identified as influential in the decision to teach and presented in the survey as: 'My traits (e.g., intelligence, patience)'. Where career changers perceived themselves to possess traits well-suited to teaching, this may have enabled them to choose STEM teaching. Conversely, if career changers felt they possessed traits ill-suited for teaching (e.g., lack of patience), this factor may have constrained career changers and influenced the decision to not choose a STEM teaching career. Presenting the factors this way allowed respondents to contextualise the most important properties that emerged during their reflexive deliberations and influenced their decision regarding a STEM teaching career.

In this instrument, factors were presented in sets of five that comprised one question. The factors were arranged into question sets using a Balanced Incomplete Block Design (BIBD) mathematical model (Louviere et al., 2015). This approach arranges factors so that each factor is presented against each other an equal number of times, using the fewest question sets possible. Each factor appeared five times across the scale, resulting in 21 questions. An example question is presented in Fig. 1.

The chosen arrangement incorporated a Youden design, where each factor is presented in each position across a five-question set (e.g., first, second, last). This variation strengthens validity and negates the risk of question order bias (Crouch & Louviere, 2007). By comparing the choices respondents made within each set, the factors were quantitatively ranked into a hierarchy of mean relative importance

Choose one option on the left to indicate the factor that was **most** important to you, and one option on the right to indicate the factor that was **least** important to you, in your decision about teaching.

Most important		Least important
O	The salary of teaching	O
O	Working with young people	O
O	The workload of teachers	O
O	The holidays	O
O	How society treats teachers	O

Fig. 1 Example of a BWS question

(Louviere et al., 2015). To further enhance validity, iterations of the survey were reviewed by two experts in BWS methodology and pilot tested by five respondents that met the inclusion parameters (explained below). Post-survey interviews provided feedback on the survey format and coherence. The scale factors and overall survey design were also appraised by a panel of four experienced science teacher education academics, and all feedback was used to refine the instrument before dissemination.

Respondents accessed the online survey through the Qualtrics digital survey platform. The first section of the survey collected demographic information including gender, age, and STEM teaching decision. Responses to the question 'Are you planning to become a STEM teacher?' were used to categorise respondents as either pursuing (response options of 'yes, definitely' and 'probably will') or passing on a teaching career (responses of 'no, definitely not' and 'probably not'). The survey instructions then tasked respondents with identifying the factors that most influenced this decision; meaning those who chose to pursue teaching identified the factors that *enabled* this choice, whereas those who chose not to teach identified the barriers (*constraints*) that most influenced this choice. Section two of the instrument presented the BWS questions, and the third section allowed respondents to provide open-ended clarifying information.

Participants

The survey was completed by a convenience sample of 91 Queensland career changers (21 + years of age) who had considered becoming a STEM teacher. Table 2 summarises key demographic information of these respondents. Fifty-three (58%) of the career changers elected to pursue a STEM teaching career, whereas 38 (42%) respondents chose to pass on a STEM teaching career. Most respondents were female ($n = 58$, 64%), 26 (28%) were male, and 7 (8%) were non-binary or preferred not to say. Thirty-six respondents (40%) were aged 21–24 years, 30 respondents (28%) aged 25–34 years, and 25 respondents (28%) aged over 35. Although we acknowledge the potential limitations in the representativeness of this sample, we are confident that our data contributes to understandings previously absent from the research literature.

Table 2 Characteristics of BWS survey respondents ($n = 91$), with row percentages presented

	BWS pursue	BWS pass	n
Female	33 (57%)	25 (43%)	58
Male	15 (58%)	11 (42%)	26
Non-binary, or prefer not to say	5 (71%)	2 (29%)	7
21–24 years	18 (50%)	18 (50%)	36
25–34 years	20 (67%)	10 (33%)	30
35+ years	15 (60%)	10 (40%)	25
Total	53 (58%)	38 (42%)	91

Participants were recruited through invitations posted on learning platform noticeboards for courses at four Queensland universities. The chosen courses were STEM-focused or catered to STEM ITE teaching area majors, spanning undergraduate and postgraduate programme levels. Example courses included a bridging chemistry course, an undergraduate engineering mathematics course, and a postgraduate education curriculum course aimed at pre-service secondary science teachers. These recruitment avenues were sourced through the researchers' professional networks and ensured a balance of respondents between career change pre-service teachers with a STEM secondary teaching area specialisation, and career changers enrolled into other STEM university courses. Screening questions ensured that the participants met the inclusion parameters as a career changer (21+) who had considered becoming a STEM teacher.

Data analysis

Participants' responses were analysed in Microsoft Excel using BWS scaling methods (sometimes called MaxDiff analysis) (Louviere et al., 2015). This approach calculates best (+1) minus worst (− 1) counts (BWS scores) for each response set; these simple counts have been demonstrated to predict outcomes comparably with more complex regression models (Louviere et al., 2013). The individual BWS factor scores were averaged by STEM teaching decisions to produce ranked lists of factors (from most to least influential), with BWS scores signifying the relative importance of each factor. These scores can be compared and interpreted as having ratio properties to compare the degree of influence of one factor with another (Burke et al., 2022; Louviere et al., 2015); for example, a factor assigned a ranking of two can be considered twice as influential as a factor assigned a ranking of one. Paired sample *t*-tests were conducted for each list to uncover differences in factor rankings between adjoining factors. Pearson's correlation coefficient and independent sample *t*-tests were used to compare reasons for career changers' decisions to pursue or pass on a STEM teaching career, and effect sizes indicate the strength of the relationship between these variables.

Results

Career changers who 'pursued' STEM teaching

The BWS scores for respondents who pursued a STEM teaching career ($n = 53$) are presented in Fig. 2. This graph shows the 21 factors sorted in descending order to reflect ranking of mean BWS scores, with corresponding 95% confidence intervals. Factor rankings revealed the most important factors to career changers who chose to pursue STEM teaching were:

1. The impact teaching has on society
2. Past teaching experiences (e.g. tutoring, staff training, parenting)

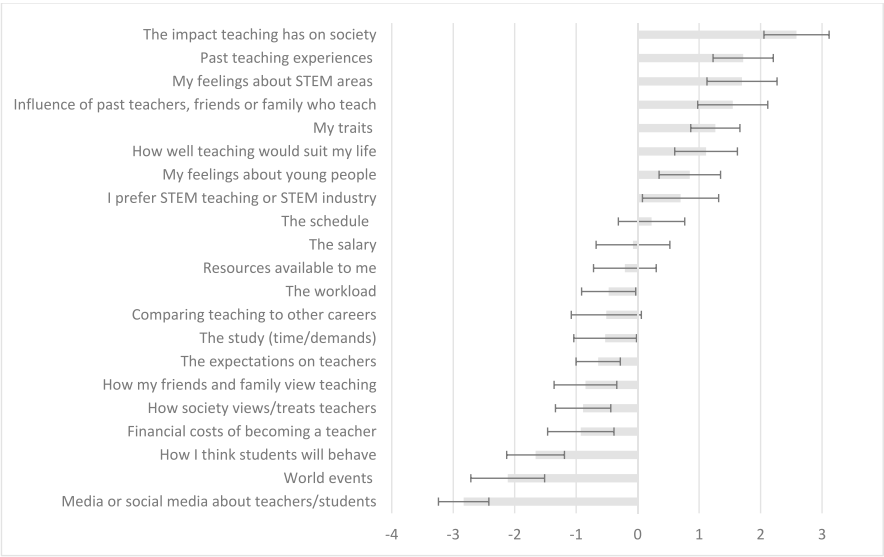

Fig. 2 Mean BWS scores for career changers who pursued STEM teaching. Error bars represent 95% confidence intervals

3. My feelings about STEM areas (e.g. like or dislike science)
4. Influence of past teachers, friends, or family who teach
5. My traits (e.g. intelligence, patience), and
6. How well teaching would suit my life

The first ranked factor, 'the impact teaching has on society' ($M = 2.58$, SD = 1.96) was significantly more important to career changers than the second ranked factor of 'past teaching experiences' ($M = 1.72$, SD = 1.83), $p < 0.05$, $t(52) = 2.53$, $p = 0.01$. The next five factors were of similar importance to adjoining ranked factors. The factors that mattered least to career changers who pursued STEM teaching were: 'how I think students will behave' (19),'world events' (20) and 'media or social media about teachers/students' (21).

Career changers who 'passed' on STEM teaching

The BWS scores for the 38 respondents who decided against a STEM teaching career are presented in Fig. 3. This graph depicts the mean BWS scores and 95% confidence intervals for the factors that career changers considered most important when deciding not to pursue a career as a STEM teacher. The most important factors for career changers who chose not to teach were:

1. The impact teaching has on society
2. My traits (e.g. intelligence, patience)

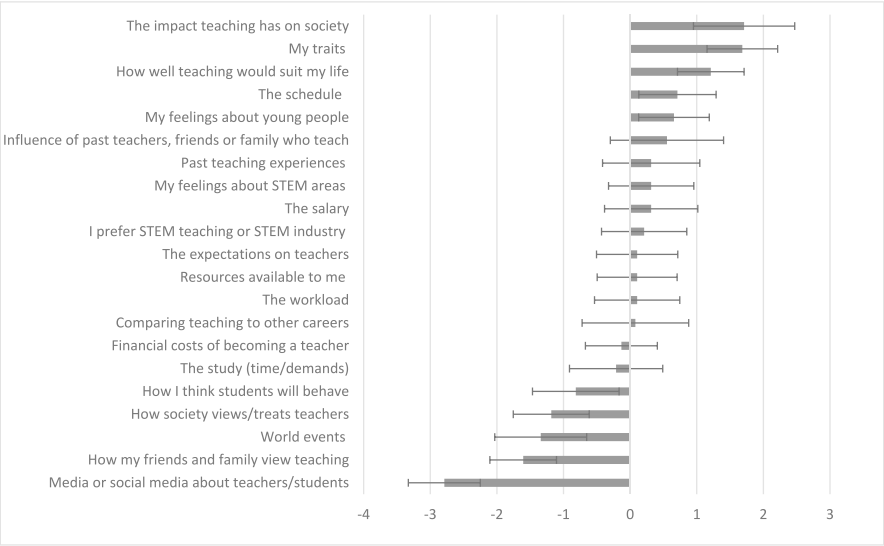

Fig. 3 Mean BWS scores for career changers who passed on STEM teaching. Error bars represent 95% confidence intervals

3. How well teaching would suit my life
4. The schedule (e.g. daily hours, holidays)
5. My feelings about young people, and
6. Influence of past teachers, friends, or family who teach.

The first two factors were rated of similar importance to one another. The second factor 'my traits' ($M = 1.68$, SD = 1.68) was significantly more important to career changers' decision-making than the fourth factor 'the schedule' ($M = 0.71$, SD = 1.84), $p < 0.01$ ($t(35) = 3.01$, $p = 0.005$) and subsequent factors. The fourth factor and adjoining fifth and sixth ranked factors were of similar importance to one another. The least important influences on the decision-making of career changers who decided against STEM teaching were: 'world events' (19), 'how my friends and family view teaching' (20), and 'media or social media about teachers/students' (21).

Comparison of BWS scores

Figure 4 presents a comparison of mean BWS values with corresponding confidence intervals for those who pursued and passed on STEM teaching careers. The BWS scores are sorted in descending order of importance by ranking of career changers who pursued a STEM teaching career. The range of scores for career changers who pursued STEM teaching (5.41, minimum -2.83, maximum + 2.58) was greater than the scores for those who passed on STEM teaching (4.50, minimum − 2.79, maximum + 1.71). Positive correlation between the scores of the two cohorts ($r = 0.85$)

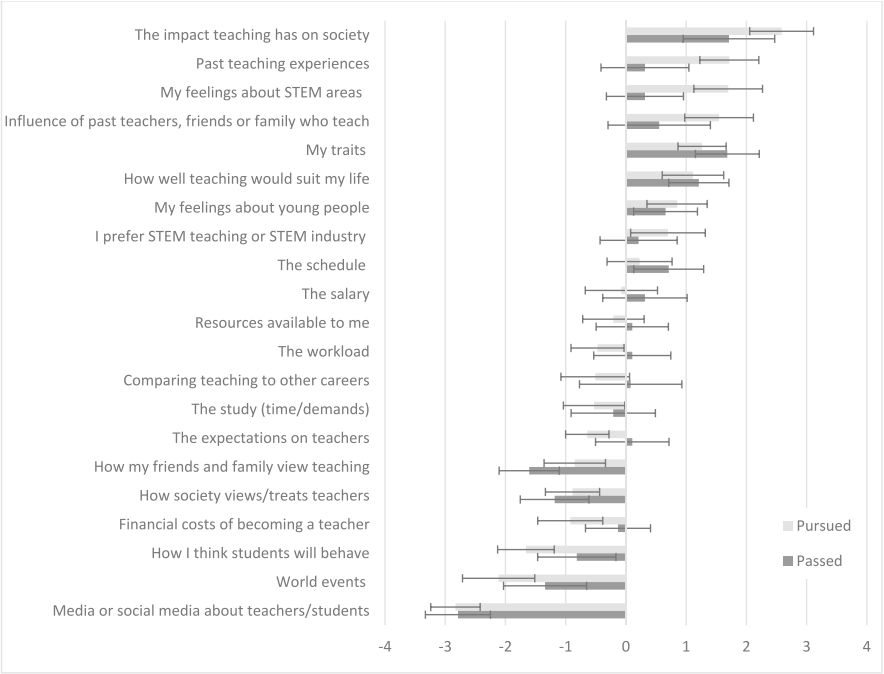

Fig. 4 Comparison of mean BWS scores for career changers who pursued and passed on STEM teaching careers. Error bars represent 95% confidence intervals

suggested that those who decided to teach and those who decided against teaching generally weighted the responses in the same way, though exceptions were identified and are discussed below.

Table 3 presents a comparison of BWS scores for career changers who pursued and those who passed on a STEM teaching career, ranked in descending order of importance for career changers who pursued STEM teaching. To determine whether the factors significantly differed in importance between groups, BWS scores were compared using independent-samples *t*-tests (assuming unequal variance). Significant findings are identified in Table 3 and discussed below.

Inferential analyses identified factors that were scored as similarly important by the career changers ($n=91$), as well as scores that were statistically different between the two groups. Regardless of the decision to teach, both groups of career changers identified 'the impact teaching has on society' as the most important reason for their decision about a STEM teaching career. There was no significant difference in the relative importance allocated to this factor by career changers who decided for and against teaching ($t(89)=1.86$, $p=0.07$). Similar conclusions were identified for most other highly ranked factors, including the 'influence of past teachers, friends, or family who teach' ($p=0.06$), 'my traits' ($p=0.22$), 'how well teaching would suit my life' ($p=0.79$), 'the schedule' ($p=0.24$), and 'my feelings about young people' ($p=0.61$). In each of these cases, the two groups of career changers considered the factor to be equally as important to their decision-making, irrespective of whether

Table 3 Independent sample *t*-test comparisons of BWS scores for career changers who pursued and passed on STEM teaching

Factor	BWS-pursue		BWS-pass		Mean difference	*t*(89)	*p*	Cohen's *d*
	M	SD	M	SD				
The impact teaching has on society	2.58	1.96	1.71	2.38	.87	1.86	.07	0.40
Past teaching experiences	1.72	1.83	0.32	2.30	1.40	3.11	.003 **	0.67
My feelings about STEM areas	1.70	2.12	0.32	2.00	1.38	3.17	.002 **	0.67
Influence of past teachers, friends or family who teach	1.55	2.11	0.55	2.66	.99	1.91	.06	0.42
My traits	1.26	1.50	1.68	1.68	− .42	1.23	.22	0.26
How well teaching would suit my life	1.11	1.88	1.21	1.56	− .10	.27	.79	0.06
My feelings about young people	.85	1.86	0.66	1.66	.19	.51	.61	0.11
I prefer STEM teaching or STEM industry	.70	2.30	0.21	2.00	.49	1.08	.28	0.23
The schedule	.23	1.99	0.71	1.84	− .48	1.20	.24	0.25
The salary	− .08	2.21	0.32	2.21	− .39	.83	.41	0.18
Resources available to me	− .21	1.91	0.11	1.90	− .31	.77	.44	0.17
The workload	− .47	1.62	0.11	2.00	− .58	1.47	.15	0.32
Comparing teaching to other careers	− .51	2.10	0.08	2.68	− .59	1.13	.26	0.25
The study (time/demands)	− .53	1.88	− 0.21	2.20	− .32	.72	.47	0.16
The expectations on teachers	− .64	1.35	0.11	1.93	− .74	2.06	.04 *	0.45
How my friends and family view teaching	− .85	1.89	− 1.61	1.57	.76	2.08	.04 *	0.44
How society views/treats teachers	− .89	1.69	− 1.18	1.80	.30	.80	.43	0.17
Financial costs of becoming a teacher	− .92	2.00	− 0.13	1.70	− .80	2.04	.04 *	0.43
How I think students will behave	− 1.66	1.75	− 0.82	2.04	− .84	2.06	.04 *	0.44
World events	− 2.11	2.22	− 1.34	2.16	− .77	1.66	.10	0.35
Media or social media about teachers/students	− 2.83	1.53	− 2.79	1.71	− .04	.12	.91	0.02

*$p < .05$, **$p < .01$

that factor enabled them to pursue STEM teaching, or emerged as a constraint that influenced them to pass on a STEM teaching career. This trend was similar for less important factors, with career changers generally positioning factors as similarly important regardless of their teaching decision.

Some exceptions were identified, where factors were more important to career changers who either pursued or passed on STEM teaching. For example, career changers who chose to pursue teaching scored 'past teaching experiences' as more important to their deliberations than did career changers who decided against teaching ($p=0.003$), with a moderate effect size indicated ($d=0.67$). Similarly, 'feelings about STEM areas' were more important to career changers who pursued STEM teaching and mattered less to those who passed on the opportunity ($p=0.002$) with a moderate effect size ($d=0.67$). Among the less important factors, 'the expectations of teachers' ($p=0.04$), 'the financial costs of becoming a teacher' ($p=0.04$) and 'how I think students will behave' ($p=0.04$) were all significantly more important factors influencing career changers who chose to reject a teaching career than those who pursued it. In real terms, these three factors were more influential in deterring career changers who decided not to teach, but less important as enablers to those who chose teaching. In contrast, career changers who chose to teach were more influenced by 'how friends and family view teaching' than were career changers who decided to pass on teaching ($p=0.04$). In each of these four instances, the effect size was small ($0.40<d<0.50$, Table 3).

Discussion

Table 4 summarises the BWS factors that were identified as the most important influences on the decisions of 91 career changers to pursue or pass on STEM teaching careers. These factors are now characterised and discussed as personal (PEP), structural (SEP), or cultural (CEP) emergent properties that arose to either enable career changers to pursue STEM teaching or act as a constraint against pursuing STEM teaching. As a reminder, PEPs include individual identities, beliefs, dispositions, and experiences; SEPs refer to properties of institutions and organisations; and CEPs encompass shared beliefs, attitudes, and broader social values (Archer, 2007).

Career changers in this study identified PEPs as the most important factors enabling their decisions to pursue STEM teaching. As these career changers envisioned themselves as teachers, the anticipation that teaching would align well with their priorities, experiences, and beliefs was enabling (Archer, 2007). Career changers were most strongly influenced by the positive impact of teaching on society; this finding closely aligns with established literature highlighting the capacity of a teaching career to 'make a difference' to young people or communities (Grier & Johnston, 2009; Richardson & Watt, 2005). Past teaching experiences and positive feelings towards STEM subjects also enabled the decision to teach; these emergent properties enhanced career changers' beliefs that they could be capable teachers and would enjoy teaching STEM subjects. Corresponding examples in the literature depict individuals who initially chose STEM careers due to a love of science, before teacher-like experiences in vocational or

Table 4 Most important factors arising to enable or constrain career changer's STEM teaching decisions, mapped to Archer's enabling/constraining emergent properties

Pursued STEM teaching		Enabling		
		PEP	SEP	CEP
1	The impact teaching has on society	✓		
2	Past teaching experiences	✓		
3	Feelings about STEM areas	✓		
4	Influence of past teachers or friends/family who teach	✓		
5	My traits	✓		
6	How well teaching would suit my life	✓	✓	
Passed on STEM teaching		Constraining		
		PEP	SEP	CEP
1	The impact teaching has on society	✓		✓
2	My traits (e.g. intelligence, patience)	✓		
3	How well teaching would suit my life	✓	✓	
4	The schedule (e.g. daily hours, holidays)		✓	
5	My feelings about young people	✓		
6	Influence of past teachers or friends/family who teach	✓		

volunteer contexts motivated them to change careers to science teaching to incorporate their passions for science and teaching (Smetana & Kushki, 2021).

Career changers were also motivated to teach by the influence of past teachers, friends, or family who teach; these associations may have provided inspiration or insider perspectives on the career. Some literature suggests that these associations instil a sense of being 'destined' to teach; one research scientist-turned-career-change teacher suggesting it was 'written into the DNA' after she, her parents, and a sibling had all chosen teaching (Wilkins & Comber, 2015, p. 1019). Career changers who pursued STEM teaching were confident that their personal traits were well-aligned to teaching, these enabling traits include people skills, flexibility, maturity, patience, and resilience (Grier & Johnston, 2009). Additionally, career changers were enabled to teach when they expected the career conditions to suit their life circumstances; this may be considered both a PEP and a SEP as it encompassed both personal priorities (e.g., parenting responsibilities) and conditions of the career (e.g., work stability, holidays) (Whannell & Allen, 2014).

Overall, the predominance of PEPs rather than SEPs or CEPs suggests that career changers in this study chose STEM teaching in anticipation of a meaningful and enjoyable career that suited their interests and personal traits. These career changers appeared less concerned with the conditions of ITE, the teaching career, or social views of the profession. These findings align with the broader body of research that emphasises the influence of intrinsic and altruistic motivations over

extrinsic factors in motivating career change teachers (Richardson & Watt, 2005; Varadharajan & Buchanan, 2021).

Although career changers who pursued teaching were predominantly influenced by PEPs, those who chose to forego STEM teaching were constrained by PEPs, SEPs, and CEPs. The prominent constraint identified by career changers who passed on STEM teaching was the impact teaching has on society. We found this surprising and suggest that the notion that teaching lacks positive social impact could be due to 'discourses of derision' (Ball, 2012) in broader social conversations that promote deterrent ideologies about teachers or the profession. These disparaging discourses are exemplified in the current 'crisis rhetoric' that negatively emphasises aspects of the profession, including (lack of) teacher knowledge, (poor) student achievement or discipline, teacher shortages, and (ill)-preparedness of pre-service teachers (Blennow et al., 2023). Our research suggests that these conceptions promote deficit views of the social impact of teaching (both a PEP and a CEP), resulting in career changers feeling unable to 'make a difference' in the profession and consequently discouraged from pursuing STEM teaching.

In addition to constraints regarding social impact, career changers were most deterred from STEM teaching when they identified traits that rendered them ill-suited to teach (a PEP). Examples of these deterrent traits may include academic self-efficacy concerns or a lack of empathy towards teenagers (Siostrom, 2023). Career changers who passed on STEM teaching were also constrained by perceptions that teaching would not suit their life circumstances (both a PEP and an SEP) and that the teaching schedule was inflexible (SEP). We theorise that the surge of post-pandemic alternative working arrangements has heightened expectations regarding work-life balance and schedule flexibility, consequently rendering the static conditions of the teaching profession less desirable. As a third of the national workforce boasts flexible working hours and more than 40% now regularly work from home (Australian Bureau of Statistics, 2022), role flexibility and life-fit is likely to become increasingly important for those considering career change. Other important PEPs that constrained career changers from pursuing STEM teaching include feelings about young people, and the influence of past teachers, friends, or family who teach. Research suggests that these deterrent feelings may include concerns about teenage disengagement or disinterest in learning, and that negative teaching experiences shared by close networks can discourage career changers from pursuing a teaching career (Siostrom, 2023).

Given that many career changers consider STEM teaching following disillusion or dissatisfaction with prior roles (Watters & Diezmann, 2015), deliberations encompassing a blend of PEPs, SEPs, and CEPs are understandable. Prior career experiences and existing life commitments likely shape career changers' expectations of the vocational roles, structures, and social values that will best align with personal priorities and circumstances. These career changers seek out roles that offer a harmonious blend of social impact, personal enjoyment, and work-life balance. Where career changers feel unable to make a difference, ill-suited to the profession, perceive the schedule as inflexible or hold negative perceptions of students or teaching, the decision to pass on STEM teaching is unsurprising. In this instance, career changers enact personal agency to choose alternative careers better aligned

with their ultimate priorities (Archer, 2007). Given that career changers who pursue and pass on STEM teaching differ in the factors that they prioritise, further research is timely to explore whether these may be influenced by different prior careers, backgrounds, modes of reflexive deliberation (Archer, 2007) or other reasons.

In considering these findings in the light of the current policy moment, specifically the actions as outlined in the *National Teacher Workforce Action Plan* (Department of Education, 2022), many recommendations do not appear to align with the factors indicated as most important by career changers in this study. Current recruitment discourse is dominated by financial incentives such as bursaries and paid pathways or proposes interventions to 'improve' teacher education programmes to attract new applicants. However, career changers in this study ranked the financial costs, duration, and demands of ITE as relatively unimportant in their overall decision-making, positioning these within the least important third of factors. The relatively low ranking of financial costs is supported by research suggesting that financial incentives attract only those inclined towards teaching but are not successful in recruiting or retaining teachers in shortage areas (Munthe & See, 2022). However, this finding remains contested, with some scholars and policy groups (see Varadharajan & Buchanan, 2021; Goss & Sonnemann, 2019) arguing that financial incentives play a crucial role in the decision to teach, particularly for career changers transitioning from well-paid STEM careers. It remains to be seen whether the current support bursaries will make an impact on the number of career changers entering and staying in the profession.

One recent policy initiative holds promise, however, with Queensland set to implement flexible timetabling arrangements for schools starting from 2024. Potential options include extended daily hours or a four-day week (Department of Education, 2023b). Though intended to ease staffing shortages and enable teacher planning time, this initiative has the potential to reshape career changers' perceptions of the life suitability and flexibility of teaching, potentially raising the appeal of the profession. However, this initiative may not be as appealing to families. Beyond this initiative, our research suggests that recruitment initiatives emphasising career changers' capacities to 'make a difference' or promoting the value of diverse traits in teaching are also likely to positively influence career changers considering STEM teaching.

Conclusion and recommendations

The use of the BWS methodology in this study has fostered an understanding of the most important influences on career changers' decisions to pursue or pass on a STEM teaching career. Career changers in this study were attracted to teaching by the positive impact teaching has on society, past teaching experiences, feelings about STEM areas and influences of social networks, yet others were deterred by derisive discourses regarding the impact of teaching, personal traits, or concerns about teaching and the schedule not suiting their life. Given sample size limitations and the recruitment of participants from geographically similar universities, the researchers were unable to explore whether influences differed according to age, gender, or ITE entry pathway. Similarly, the absence of demographic data concerning respondents'

prior work or study experiences inhibited the authors from drawing conclusions regarding the influence of prior STEM careers or study experiences on career changers' decisions to pursue or pass on STEM teaching, A national study is recommended as the next step to assess the generalisability of these findings, and compare factors of influence for different cohorts, such as career changers with prior STEM experiences or those entering teaching through undergraduate pathways.

Having successfully navigated other vocational and social roles, career changers in this study deliberated on potential STEM teaching careers by weighing up the perceived impact of the role, along with personal experiences and whether the profession will suit their lives. Given the findings described above, we suggest that financial incentives and changes to 'improve' ITE may prove insufficient panaceas for many career changers seeking a socially impactful, enjoyable, and well-suited role. Rather than seeking the 'right' incentive to attract teachers to the profession, efforts would be better focused on making the profession attractive to future (and current) teachers. Steps in this direction could include additional interventions to enhance role flexibility, broadening conceptions of traits of 'good' teachers, and placing higher value on the important social contribution of teachers, along with addressing workload concerns contributing to attrition (Brandenburg et al., 2023). Inspiration can be drawn from the policies enacted in countries rated highest for teacher satisfaction and prestige of the profession, including Canada, Vietnam, and China (Organisation for Economic Cooperation & Development, 2019). Successful measures could work on two fronts: enhancing recruitment efforts while promoting the retention of existing teachers in the profession.

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