



Learning environments to develop vocational excellence

A Report to the National Apprenticeship Service of Project 2 of the DUVE suite of projects

DuVE: Developing and understanding vocational excellence

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Preface

The National Apprenticeship Service (NAS) champions apprenticeships throughout England. It works to foster partnerships with industry and education organisations to identify, develop and train, and support vocational talent through skills competitions. WorldSkills UK, housed within NAS, manages the local, regional and national competitions and the Squad UK in preparation for WorldSkills Competitions (WSC). As a developer of vocational talent it is interested in understanding what factors contribute to talent development. NAS commissioned a suite of three projects, carried out by the ESRC Centre on Skills Knowledge and Organisational Performance (SKOPE) under the banner *Developing and Understanding Vocational Excellence (DuVE)*. The purpose of these projects is to better understand how participation in WSC, through WorldSkills UK, contributes to NAS's aim of promoting skills development and improving the skills base in the UK.

This report is the second produced for project 2, Learning Environments to Develop Vocational Excellence. Other DuVE reports include the following:

- *Benefits of Developing Vocational Excellence. A Report to the National Apprenticeship Service of Project 3 of the DUVE suite of projects 2013* by K. Mayhew, S. James, M. Chankseliani, and A. Laczik.
- *Understanding and Developing Vocational Excellence. A study of the WorldSkills UK Squad 2013* by P. Nokelainen, C. Stasz, and S. James.

Other publications and presentations on vocational excellence can be found at:

www.vocationalexcellence.education.ox.ac.uk

Summary

WorldSkills UK selects and prepares young people, mostly aged 18-22, to compete in the World Skills Competition. The selection process begins with numerous regional and national skill competitions held throughout the UK. Competitors for these UK-based competitions may be Further Education college students or apprentices or employees in enterprises that recognise the benefits of skills competitions. Prior to competition, they have developed a range of skills and knowledge in their chosen field through coursework and/or workplace experience. Research has demonstrated that the learning environment in a workplace can be crucial for skill development. This research extends that work by looking specifically at how the learning and working environment experienced by WorldSkills UK participants affects team selection and success at WSC. It addresses three key questions:

- What are the features of the learning environments for WorldSkills UK participants and non-participants?
- Do these differ for squad and team members? For WorldSkills UK participants versus non-participants?
- Are they related to performance at the WSC?

The results presented in this report are based on 306 survey responses. We surveyed 75 team members, 152 squad members, 51 young people not involved in WorldSkills (Non-WS) and 28 employers from across the 2009, 2011 and 2013 WSC. Using statistical analysis the survey responses are compared across these groups and in seven different areas. The findings show that:

- Aspects of the seven areas of focus work together to help the young person develop their skill and knowledge to a high level and these areas all tend to be on the expansive end of the continuum for these workplaces.
- Team and medal winners scored higher on four particular factors: working with colleagues; understanding the aims and goals of the workplace; using a range of skills in their work; assessing their own performance.
- The prospect of progressing from squad to team did not significantly depend on the year of the competition or the particular skills cluster; however, there are strong sectoral/skill cluster distinctions with regards to the work environment (“ENVIRONMENT”) and the types of tasks performed at work (“TASK”).
- Participants with higher scores for both TASK and ENVIRONMENT showed signs of performing better, in particular in their progression into the squad and then from the squad to the final team.

- Team members scored higher for TASK and lower for ENVIRONMENT on average than squad members who did not make the team. The more expansive the workplace on the two factors combined, the more likely the young person is to make the team. On their own these factors do not make a significant contribution; it is the combination of the environment and support for the young person by the firm with the particular tasks they are engaged in which is key to developing excellence.
- However, medal winners scored lower for both measures, on average, than non-medal winners.
- The group surveyed from outside the skills competitions (Non-WS) tended to score higher on average than the competitors for ENVIRONMENT, but lower for TASK.

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1. Introduction

The World Skills Competition (WSC) is recognised by many as the pinnacle of excellence in vocational education and training (VET). From its beginnings in the early 1950s this competition has evolved into a global contest. The WSC Leipzig 2013 competition involved young contestants from 53 countries who competed in 46 skill areas (Appendix A). The competitions are set at high international standards and medals are awarded for excellence. Thus, the WSC provides both a benchmark for high performance and an objective way to determine what contributes to vocational excellence.

The UK first entered a team in the WSC in 1953. WorldSkills UK selects the most talented and young people, mostly aged 18-22,¹ to compete in WSC, through a multi-stage process to identify squad and team members. Candidates may be Further Education college students or apprentices or employees in enterprises that recognise the benefits of skills competitions. They may be identified at numerous regional and national skill competitions held throughout the UK or through the National Apprenticeship Awards, Awarding Bodies, City & Guilds Awards of Excellence, Sector and Industry Awards and through Sector Skills Councils. During the first stage of the process candidates attend a residential induction programme where three to four events may be held over a few months. Advancement from the shortlist to the squad involves two weeks training followed by a 'pressure test' benchmarked to the WorldSkills International standards for facilities, test projects (often it is the test project from a previous WSI competition), marking schemes and rigour. Successful candidates are selected to the squad and participate in a training programme over approximately six months (including further competitions). Squad members compete for places on Team UK at an annual Skills Show, in a four-day competition event replicating as much as possible the conditions of a WSC. Those selected for Team UK continue with intensive skill development and training² to build their skills to world-class standard.

Most participants in this process have spent some time in the workplace, either as a full-time employee (apprentice), part-time employee or on some form of internship, although some are full-time students. While some of their skill development takes place within educational institutions, especially Further Education colleges, the majority of their learning and training occurs in the workplace. Prior research has identified a number of factors that promote learning in the

¹ The upper age limit to compete at a WSC is 22; the exception to this rule is for the skills areas of Information Network Cabling, Manufacturing Team Challenge, Mechatronics, and Aircraft Maintenance where the age limit is 25 years in the year of competition.

² Some members of Team UK also compete in EuroSkills as part of their training: <http://www.euroskills.org>

workplace. This study extends that work by investigating the learning and working environments of a group of young people involved in WorldSkills UK training. It addresses three questions:

- What are the features of the learning environments for WorldSkills UK participants?
- Do these differ for squad and team members? For WorldSkills UK participants versus non-participants?
- Are they related to performance at the WSC?

It builds upon previous research on learning environments conducted with the 2009 and 2011 squads (James and Holmes, 2012).

Structure of the report

This report is organised as follows. Section 2 provides details about the approach and methods used in this project. Section 3 analyses the learning environments within the work environments of the participants to better understand the opportunities for developing skills and knowledge. Section 4 addresses the second research question focuses on the relationships between aspects of the learning environment at work to understand any differences between WorldSkills UK participants versus non-participants, and between squad, team and medal winners. We conclude with Section 5.

2. Approach and methods

Earlier research, particularly by Eraut (2000, 2004 and 2007) and by Fuller and Unwin (2003a), identified a number of factors that promote learning in the workplace. Eraut and his colleagues extensively researched the development of knowledge and skills in professional work and the significance of workplace learning for individuals, groups, and organisations. They developed a typology (Table 1) to characterize how individuals construct knowledge and skill in the workplace. The learner gains understanding, constructs knowledge and skill, recognises the knowledge resources in the workplace and how to access them, and makes judgements on his/her work to refine performance. The knowledge and skills are then utilised, reinforced and transferred to enhance performance.

While their work concentrated on learning in the professions, it is applicable to other workplace settings. Fuller and Unwin's research into apprenticeships found that an expansive work environment, as opposed to a restrictive one, is characterised by a number of features (see Table 2) that create more, stronger, and richer learning opportunities for an apprentice to develop a greater breadth and depth of knowledge and skills.

The learning typology and continuum were used to develop a survey that focused on identifying those aspects of the workplace that contribute to offering more expansive working environments.

The survey was piloted with the help of a trainer from WorldSkills UK who had worked closely with the employers and young people vying for selection into the 2009 WorldSkills UK Team.

Table 1: A typology of learning for and in the workplace
Source: Eraut et al., 1998; cited in Eraut, 2000, p. 6

Understanding	Skills
Understanding of situations and systems	Technical skills
Understanding of colleagues and work unit	Learning skills
Understanding of own organisation	Interpersonal skills
Understanding of self	Thinking skills
Strategic understanding	
Propositional knowledge	Judgment
General knowledge taught during initial training for occupation	Quality of work
Specialised occupational knowledge	Evaluation
Firm-specific knowledge (technical)	Strategic decisions
Knowledge of systems and procedures	Staff issues
	Prioritising
Knowledge resources and how to access them	
People in the department/work group	
People elsewhere in the organisation	
Internally available materials: manuals, records, databases, learning materials	
Networks of customers, competitors, suppliers	
Professional networks	
Higher Education institutions	
Local networks	
Previous employers	

Table 2: The expansive/restrictive continuum

▪ Expansive environment	▪ Restrictive
▪ Participation in multiple communities of practice inside and outside the workplace	▪ Restricted participation in multiple communities of practice
▪ Primary community of practice has shared 'participative memory': cultural inheritance of apprenticeship	▪ Primary community of practice has little or no 'participative memory': no or little tradition of apprenticeship
▪ Breadth: access to learning fostered by cross-company experiences built in to programme	▪ Narrow: access to learning restricted in terms of tasks/knowledge/location
▪ Access to range of qualifications including knowledge-based VQ	▪ Access to competence-based qualification only
▪ Planned time off-the-job including for college attendance and for reflection	▪ Virtually all-on-job: limited opportunities for reflection
▪ Gradual transition to full participation	▪ Fast – transition as quick as possible
▪ Apprenticeship aim: rounded expert/full participant	▪ Apprenticeship aim: partial expert/full participant
▪ Post-apprenticeship vision: progression for career	▪ Post-apprenticeship vision: static for job
▪ Explicit institutional recognition of, and support for, apprentices' status as learner	▪ Ambivalent institutional recognition of, and support for, apprentice's status as learner
▪ Apprenticeship is used as vehicle for aligning the goals of developing the individual and organisational capability	▪ Apprenticeship is used to tailor individual capability to organisational need
▪ Apprenticeship design fosters opportunities to extend identity through boundary crossing	▪ Apprenticeship design limits opportunity to extend identity: little boundary crossing experienced
▪ Reification of apprenticeship highly developed (e.g. through documents, symbols, language, tools) and accessible to apprentices	▪ Limited reification of apprenticeship, patchy access to reificatory aspects of practice

Source: Fuller and Unwin, 2003a, p. 8

2.1. Participants

The survey sample consisted of the young people in the WorldSkills UK squads in 2009, 2011 and 2013, employers of 2009 and 2013 team members, and a group of young people pursuing similar occupations but not involved in WorldSkills UK (see Appendix B). The majority of the squad members in 2009 and 2011 completed the survey at the beginning of their team selection week. The 2013 participants completed the survey at the beginning of their squad selection week, which resulted in survey responses from squad and non-squad members for this year. The Non-WS group were contacted through their colleges. The person responsible for apprenticeship at those colleges selected a group of young people from a similar range of skills to those in the UK squad. That individual administered the hardcopy survey and posted completed surveys to the research team. Employers completed a postal survey and returned it in a self-addressed envelope. A total of 306 surveys were available for analysis (see Table 3).

Table 3: Breakdown of participants

	2009	2011	2013
Team	21	31	23
Squad	36	36	47
Non-squad	--	--	33
Non-WS	--	--	51
Employers	11	--	17
Total	68	67	171

Once the results of the 2009, 2011 and 2013 WSC were available, team members were further designated as medal winners or non-medal winners.

2.2. Analysis

The survey consisted of two parts. Items in Part One were drawn from the typology shown in Table 1 and were intended to get the respondent to think about their workplace. These data were not used in the analysis. Items in Part Two were drawn from the continuum shown in Table 2 and addressed seven main areas (described further in Section 3). Responses to survey items were on a Likert scale, ranging from one to five where five is the most positive. These data were entered into Excel along with the respondent's status (Non-WS, squad, team, medal winner etc.). We performed mean calculations for the responses (Table 4 below) and calculated the percentage of responses to the questions using the Likert scale for descriptive analysis in Section 3. For example, we calculated the percentage of WS respondents (squad and non-squad) who reported a 5 response to the question 'do you participate in and understand a variety of situations and processes in the workplace?' and found that 75% of this group had access to all situations and processes.

With such a range of elements to the expansive learning environment framework (Fuller and Unwin 2010), it is likely that many of these dimensions appear together as a package, so that many

survey responses are highly correlated. Section 4 shows that these elements can indeed be reduced to a much smaller number of underlying factors, which correlate with particular sets of questions. We used exploratory factor analysis to identify the underlying trends in the responses and simplify them into broader measures of the participant's workplaces. The assumption here was that many responses in the survey will be correlated and will reflect a single underlying cause. As with all factor analyses, we faced a choice over how many underlying variables there were to consider. We applied three criteria:

- The Kaiser criterion – a sufficiently small amount of explanatory power to the existing model;³
- A scree plot – which looks to see the point where the additional explanatory power of extra variables begins to plateau; and
- A parallel analysis – this criterion suggests adding factors up to the point where one more would produce no extra explanatory power than if it were random noise.

Both the Kaiser criterion and the scree plot pointed to there being two underlying factors, which explained approximately 90% of the total variation in the data. As shown in Section 4, these factors are linked to 'the learning environment in the workplace' and 'complexity and range of task performed'. The parallel analysis suggested including an additional three factors. This later model retained 'complexity of tasks performed' as a single factor, but split the learning environment into different components, which were less strongly correlated than our initial model suggested. However, it became apparent in the later analysis that these additional factors were not adding any particular insights that could not be captured by the simple two factor model – for example, despite being estimated as different factors, there was still a lot of overlap between them. There was also the problem of interpretation – our two factor model is easy to interpret, while the five factor model is more confusing. Therefore, in our analysis in Section 4 we predominantly focus on the two factor model.

We applied the varimax rotation to our identified factors – this is a method of finding the simplest (and easiest to interpret) structure so that each survey question maps as heavily as possible onto just a single factor. Scores for the identified factors were then estimated for each individual.

2.3. Limitations

There are three important study limitations. First, the study relies on self-report. Second, while most squad members completed surveys, the findings cannot necessarily be generalised to all workplaces

³ In technical terms, the explanatory power of each factor is captured by the eigenvalue. The Kaiser criterion suggests to stop looking for additional factors once this value falls below 1, which would be the same amount of explanatory power we would expect from a single survey question unconnected with all the other responses.

outside of those involved with potential WorldSkills competitors. Thirdly, the small numbers of respondents limits the ability to identify differences where they do exist.

It is also important to note the survey was designed specifically for assessing the workplace and does not incorporate any data or analysis of individual's attributes, such as their psychological suitability for competition or reactions under pressure. These individual attributes are the focus of a parallel DUVE study (see Nokelainen et al., 2013a; Nokelainen et al, 2013b).

3. Learning environments within work environments

The survey was designed to identify aspects of the workplace that contribute to offering more expansive working environments. The underlying premise is that the more aspects of the workplace an employee is given access to – the elements identified as constituting an expansive work environment – the better the opportunities for developing skills and knowledge, leading to vocational excellence. The survey items addressed seven areas:

1. Participation and understanding of the workplace;
2. Task performance;
3. Access to resources to help learning;
4. Judgement, decision-making, problem-solving and reflection;
5. Experience, task transition and career progression;
6. Status as a worker and a learner; and
7. Organisational development.

Table 5 shows the mean scores for the survey questions (the numbers denote how items relate to the seven listed areas). Six results were significantly different for Non-WS and two for medal winners.

Table 4: Mean scores by respondent

	All ⁴	Non-WS	Non-squad	Squad	Team	Medal winners	Employers
1a Variety of situations and processes	3.90	3.78	3.63	3.90	4.01	3.98	3.75
1b Colleagues	4.38	4.51	4.06	4.33	4.62	4.59	4.10
1c Goals and aims	4.38	4.51	4.27	4.38	4.44	4.44	3.85
2a Complex problems	4.10	3.65	3.70	4.20	4.12	4.02	4.03
2b Range of Skills	4.40	4.18	4.06	4.42	4.53	4.49	4.46
2c Work with others	4.12	4.37	4.27	4.11	4.08	4.03	4.53
2d Communication and feedback	3.72	4.12	3.76	3.76	3.68	3.68	4.39
3a Mentor/coach	3.50	4.31	3.33	3.63	3.36	3.36	4.10
3b Resources	3.80	4.02	3.55	3.89	3.88	3.85	4.21
3c Qualifications	4.20	4.45	4.18	4.28	4.35	4.41	4.39
3d Training	3.80	4.15	3.82	3.91	3.83	3.96	4.57
4a Performance	4.20	4.15	4.18	4.15	4.35	4.36	4.35
4b Make decisions	4.00	3.68	3.70	4.08	4.05	4.05	3.92
4c Solve problems	4.10	3.81	3.88	4.17	4.31	4.27	4.10
4d Time to reflect	3.70	3.55	3.88	3.57	4.31	4.27	3.50
5a Experience	3.40	3.55	3.39	3.75	3.41	3.39	3.78
5b Work through tasks	3.60	3.91	3.42	3.63	3.68	3.54	3.78
5c Career progression	3.60	3.91	3.67	3.63	3.74	3.60	3.64
6a Acknowledgement	3.90	4.00	3.85	3.91	4.00	4.02	3.64
6b Recognised as learner	3.90	4.00	3.97	3.99	3.89	3.88	4.21
7a Business goals	4.00	4.00	3.97	4.02	3.89	3.88	4.21
N =	278	51	33	119	75	59	28

⁴ Excluding employers.

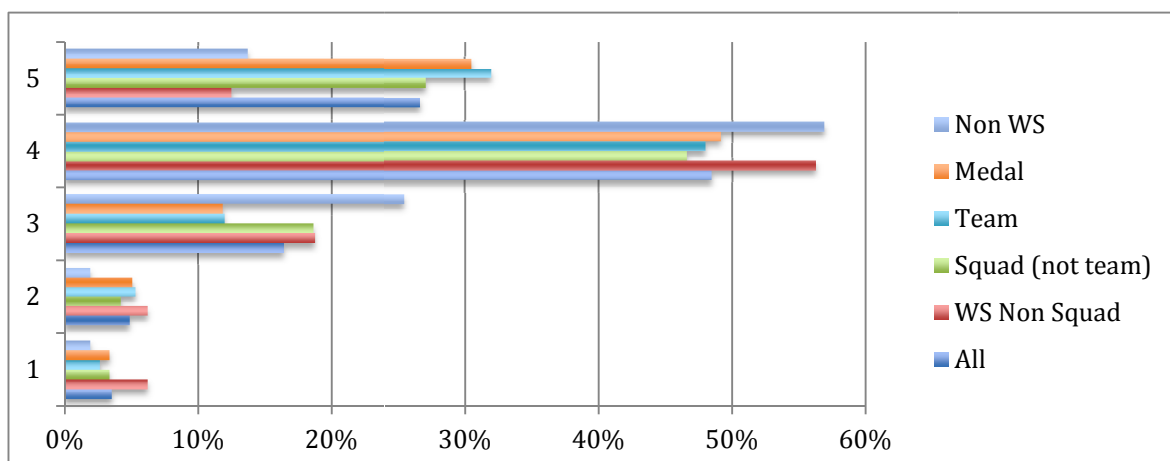
Note: 1. The numbers in **bold** in the non-WS column are significantly different (at the 5% level) to those who had some WS experience (i.e. team, squad and non-squad) participants.
 2. The numbers highlighted in the medal column are significantly different than the team members who did not win a medal.

The following sections highlight the features of the learning environment for WorldSkills UK Team participants and non-participants, and the main differences in the distribution of their responses to the seven areas listed above. Non-WS respondents are those who have not participated in competitions. Non-squad are those who tried out for the 2013 squad but did not make it. Squad are the squad members of the 2009, 2011 and 2013 squads. Team are the UK team members from 2009, 2011 and 2013. We refer to the medal winners where the differences in responses warrant mention. We do not refer to the employer data in this section given the small number of responses.

Participation and understanding of the workplace

In WSC, competitors would be expected to draw upon their skills and knowledge developed in the workplace and through WorldSkills UK training. Research shows that working environments that afford greater participation, or at least knowledge of the broader workplace, support workers better to develop skills and knowledge necessary for their occupation (Lave and Wenger, 1991; Fuller and Unwin, 2003b). Eighty percent of team members (70% of Non-WS) reported having access to all or many situations and processes in the workplace, suggesting that participation is fairly strong for both groups. Those who did not make the team or squad reported having less understanding of a variety of situations and processes in the workplace, as would be expected (Figure 1). The majority of team and non-team members (86%) knew what work their colleagues did and understood the goals and aims (90%) of the workplace. However, more team and medal winners (68% and 64% respectively) reported working with colleagues and understanding the goals of the workplace than the other groups (54%).

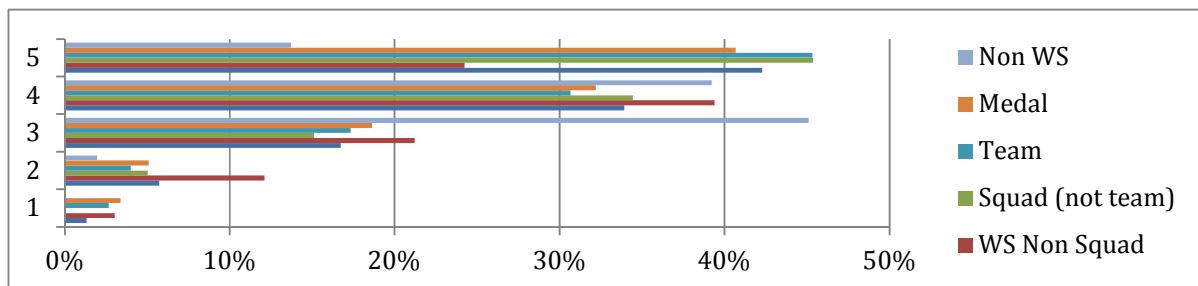
Figure 1: Variety of situations and processes



Task performance

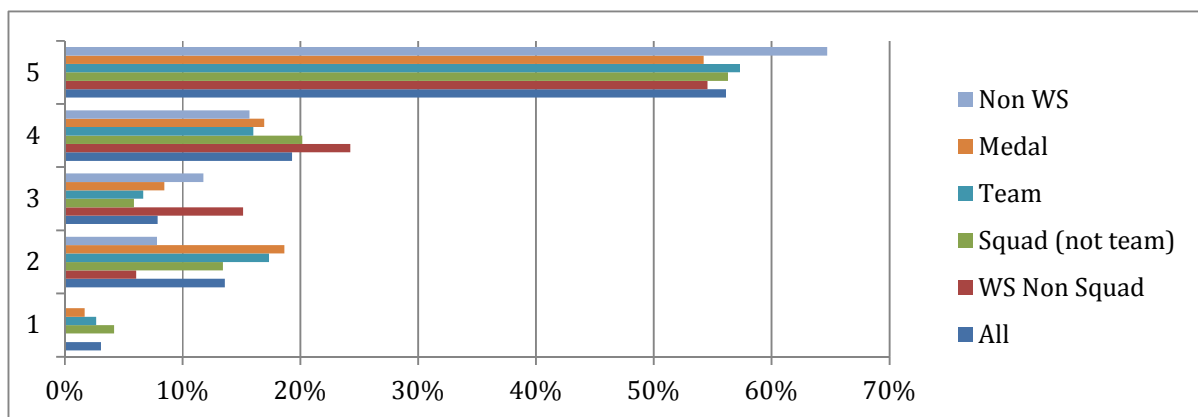
In order to develop a breadth and depth of knowledge and skill to meet the demands of the WSC task it would be expected that employees would perform a variety of tasks to develop their skills and knowledge. The participants were generally positive about aspects of the way they carried out their work. Only 7% of all respondents (1% of Non-WS) felt they did not complete many very complex tasks and problems. In performing tasks in their work, the medal winners (64%) and team members (61%) reported using more of a large range of skills to complete a variety of tasks, than non-team members (53%) (Figure 2).

Figure 2: Tackle complex problems



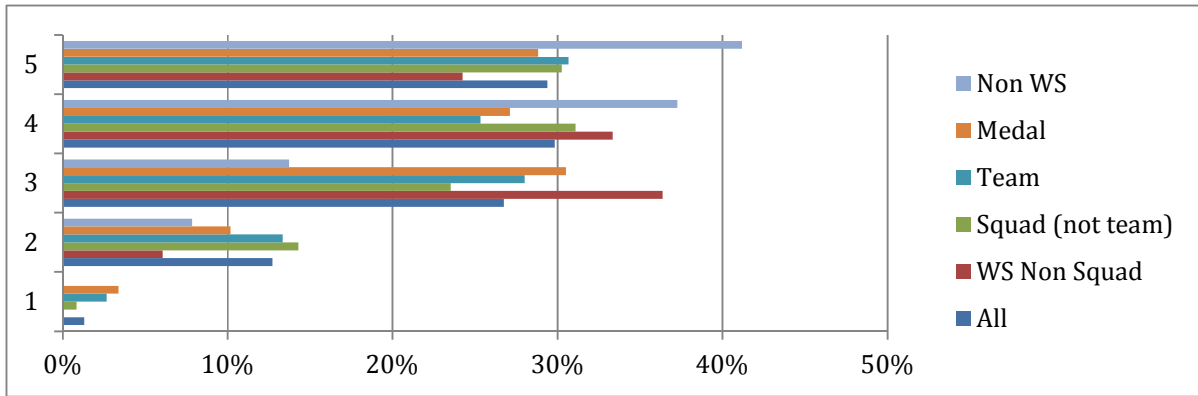
Interestingly, the perceptions of the respondents on team working were quite widely dispersed, with non-WS participants reporting higher scores for this question. Overall, 16% of TeamUK members and 15% of squad and non-squad members reported working predominantly on their own in their workplace with the occasional, or no, opportunity to learn from others (Figure 3).

Figure 3: Work with others



The responses to receiving communication and feedback on their work were more dispersed between the team and non-team members than one would expect. Thirty-one percent of team members reported receiving constant constructive communication. Sixteen per cent of team members (8% of Non-WS) reported receiving little or no communication and feedback on their work (Figure 4).

Figure 4: Receive communication and feedback



Access to resources

Individuals develop vocational skill and knowledge through the direct and indirect guidance of others in the workplace or school/college. Consequently, having access to a variety of resources in the workplace – a mentor/coach, other workers, materials, customers, competitors, suppliers, qualifications and training – would seem important for developing vocational excellence. Forty-eight percent of team members reported having a named individual as a mentor at work compared to 58% of the squad, and 28% of team members reported that while there was no one person, support was available from other colleagues (18% of squad and 28% of medal winners). Alongside having a mentor as a resource to aid learning, 66% of all the young people had access to other resources such as other workers, materials, customers, suppliers and professional networks (68% of team).

Overall, 82% of team members (92% of Non-WS) were encouraged to gain a qualification (Figure 5). However, only 63% of team members reported access to any form of on and/or off-the-job training (68% of squad; 78 % of Non-WS). Sixteen percent of WS reported having little or no access to training in the workplace (15% of squad but only 6% of Non-WS) and surprisingly 13% of these were medal winners, although this lack of training may be compensated for with the WSC training the young person is receiving (Figure 6).

Figure 5: Encouraged to gain qualifications

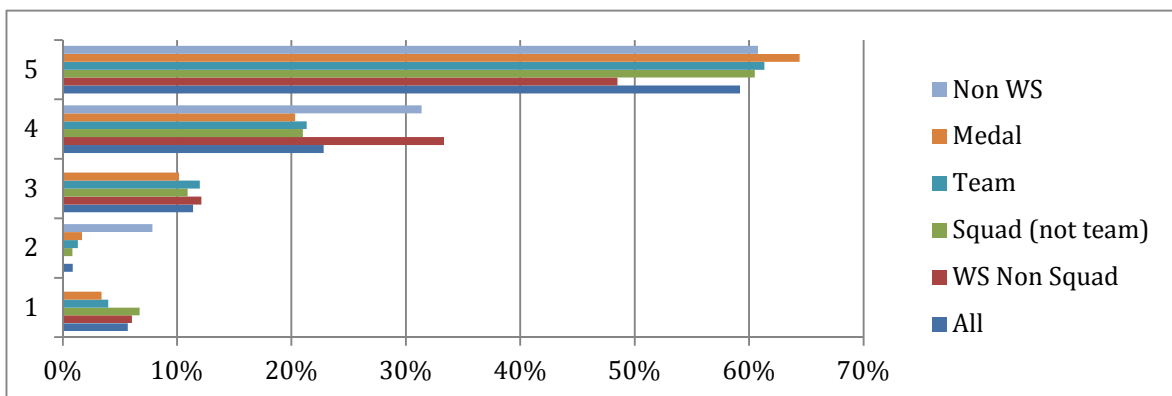
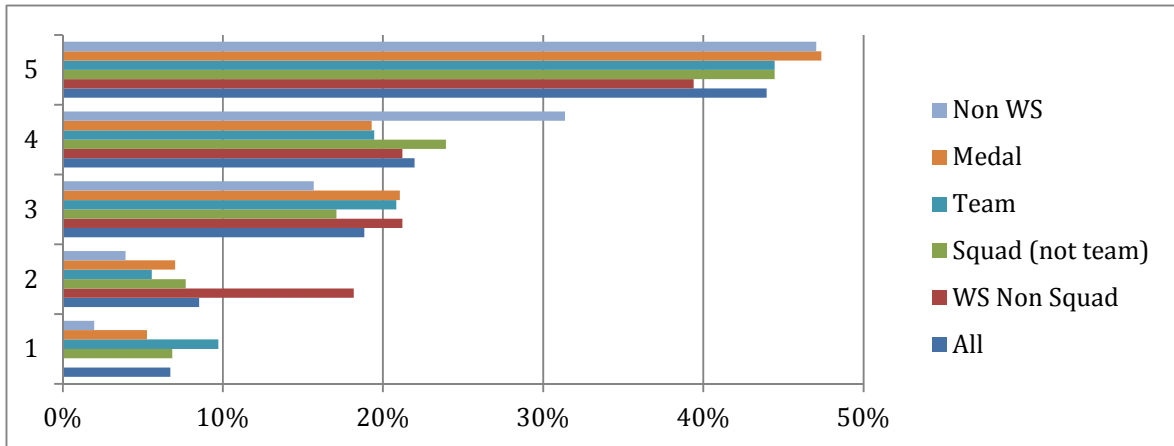


Figure 6: Receive training



Judgement, decision-making, problem-solving and reflection

Given the pressurised competition environment the smallest decision can impact greatly on outcomes. Workplaces are also fraught with their own tensions, and the opportunity to assess own performance, make decisions, solve problems and reflect on work would seem to provide a good ground for helping to develop expertise in these areas for vocational excellence. Although Felstead et al. (2007) showed that task discretion has in general decreased over the last three decades, 90% of team members and 92% of medal winners reported they were able to assess their own performance in their job (80% of Non-WS) and make changes while 95% of team members (75% of squad) said they solved problems in their jobs (dropping to 68% for Non-WS).

Fewer team members, but still a high proportion (76%), believed they were involved in decision-making, formulating and evaluating in their job (62% of Non-WS). Interestingly, fewer medal winners reported being able to make decisions than they did being able to assess their performance and engage in solving problems (Figure 7 and Figure 8).

Figure 7: Make decision

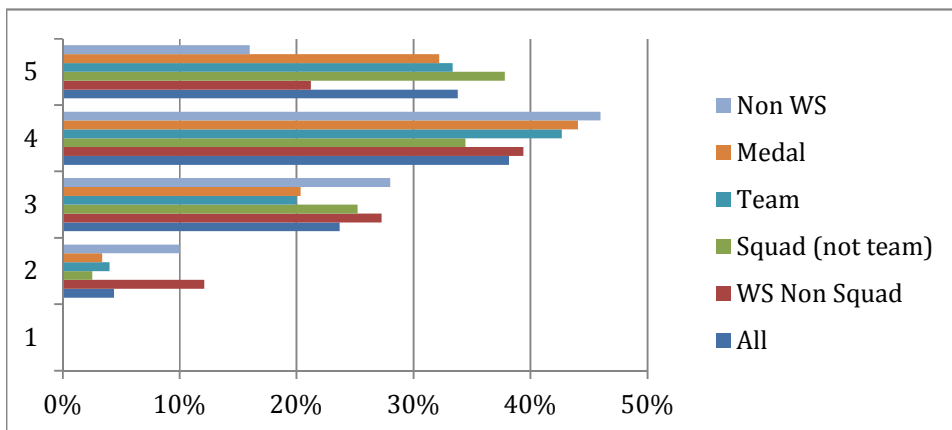
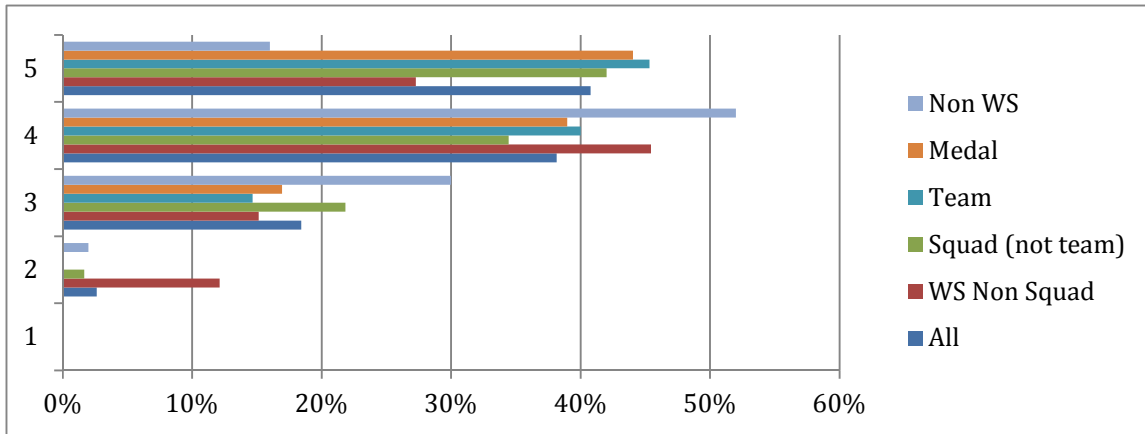
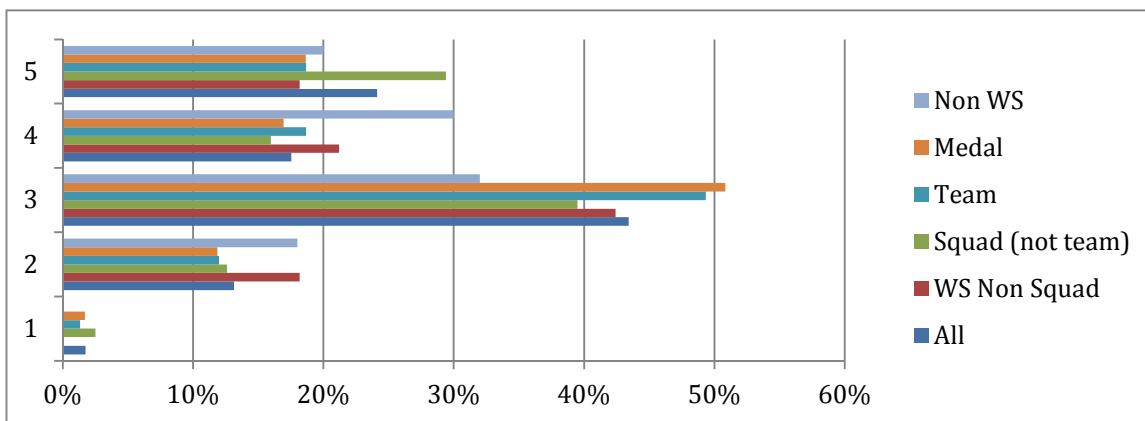


Figure 8: Solve problems



Responses to ‘reflecting on their work’ were more dispersed: 19% of team members felt they had planned time to reflect on performance and time to make adjustments (29% of squad and 20% of Non-WS); 17% (30% of Non-WS) felt they had planned time for reflection but not also time for adjustments; 49% (32% of Non-WS) reported some time to reflect while 12% (18% of Non-WS) said there was limited time to reflect on their performance (2% of medal winners reported no opportunity to reflect). It is unsurprising that time to reflect on performance is more limited given that workplaces exist to produce goods and services, and it may be that the need for reflection diminishes the better a worker becomes, as could be the case with the medal winners where 65% of medal winners reported some, limited or no time to reflect on their work. It also may be that the young people are reflecting and making more decisions but it is tacit in their work and not something they give a lot of thought to (Figure 9).

Figure 9: Time to reflect



Experience, task transition and career progression

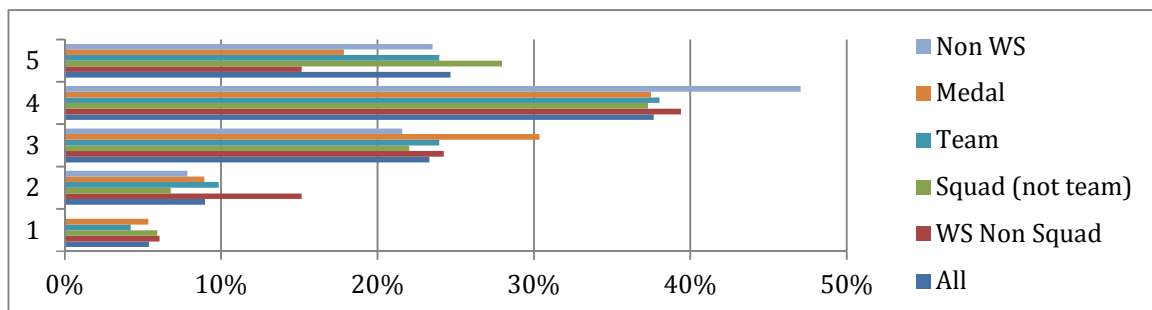
In the expansive-restrictive continuum three key elements are identified as important for developing knowledge and skill in the workplace (Fuller and Unwin, 2003a, p. 8). These are:

- Breadth: access to learning fostered by cross-company experiences built into programme;
- Gradual transition to full participation; and

- Post-apprenticeship vision: progression for career.

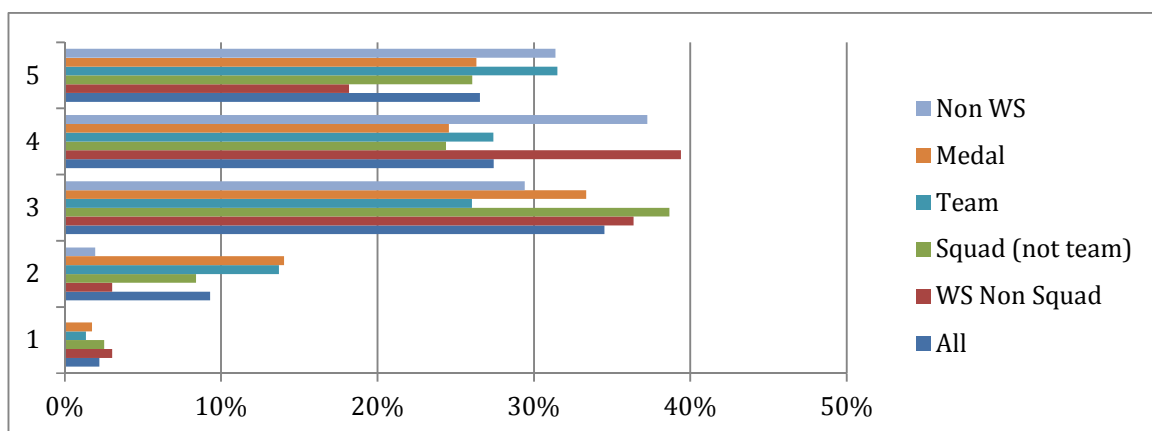
The more expansive these elements are in a workplace, the more opportunity there will be for developing vocational knowledge. Twenty-four percent of team members had planned time for, and access to, experiences across the company (28% of squad; 24% of Non-WS). A further 38% (47% of non-WS) felt there was opportunity to gain experience in most parts of the company and 24% some opportunity for experiences in some parts of the company (22% of non-WS) (Figure 10). Fourteen percent of medallists reported having no opportunity for experiences across the company or felt they had limited opportunity for experiences across the company. It may be however that that the extensive, individually tailored WorldSkills training compensated, or took the place of, experiences across the companies they worked for.

Figure 10: Experience across company



Looking at transitions to participation, 59% of team members reported a gradual transition with time allocated for gaining an understanding of most areas, and this was more frequent for non-WS at 67% (Figure 11). Twenty-six percent of the team members reported some time allowed to gain an understanding, but this was dependent on work processes (29% for Non-WS). The remaining 15% (4% of Non-WS) reported a fast transition based on limited time to gain a full understanding of work tasks.

Figure 11: Work through tasks



With 75% of WS respondents reporting they worked in a team or with others where they could see the career progression of their colleagues, it is perhaps surprising that only 43% of team

members knew about opportunities for progression with a clear career pathway mapped out. Twenty-three percent knew of horizontal and vertical career progression but also knew this offer was subject to availability and a further 21% knew some horizontal and vertical career progression but that these opportunities were heavily reliant on production processes and were not an inherent aspect to that workplace.

Status as a worker and a learner

More expansive environments recognise apprentices' accomplishments and status as a learner. Participants were asked about the acknowledgement of their work in terms of development, achievement and excellence. Only 11% of team members (less for Non-WS at 4%) thought there were limited or no opportunities for acknowledgement of their work, 41% (47% of Non-WS) felt that achievement was recognised and 31% (29%) believed achievement was celebrated (Figure 12).

Since these young people are employees in the workplace who are given time away for training it is noteworthy that 36% of team members (28% of non-WS) reported that all workers are expected to be learners in the workplace and 44% believed that learning is encouraged (much higher at 60% for Non-WS). Only 10% (6% for Non-WS) reported little or no workplace recognition of learners (Figure 13).

Figure 12: Worker acknowledged

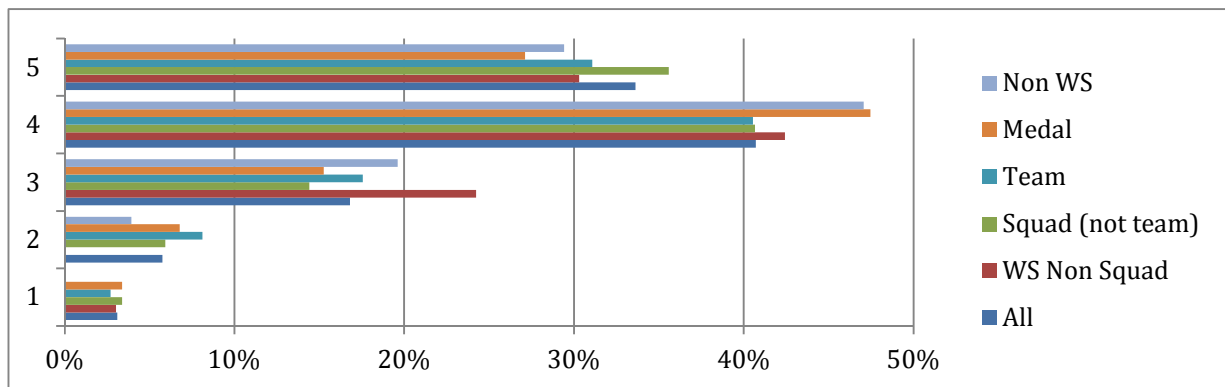
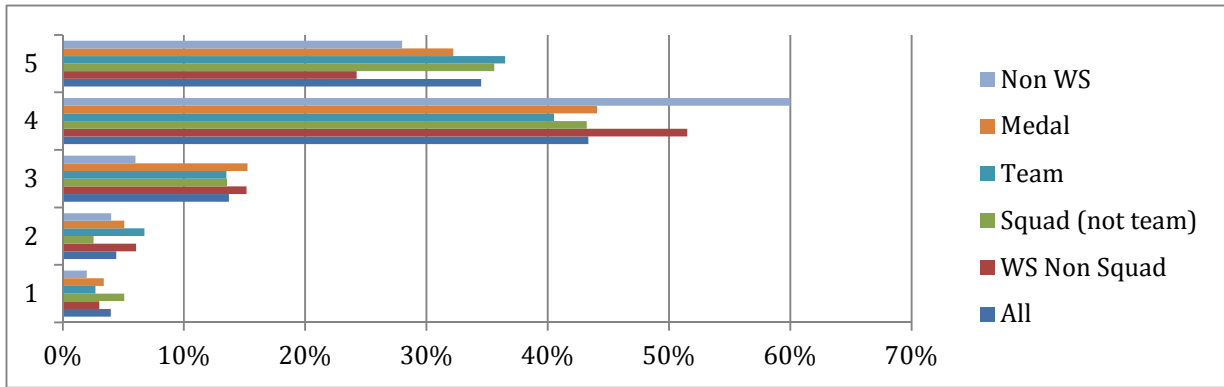


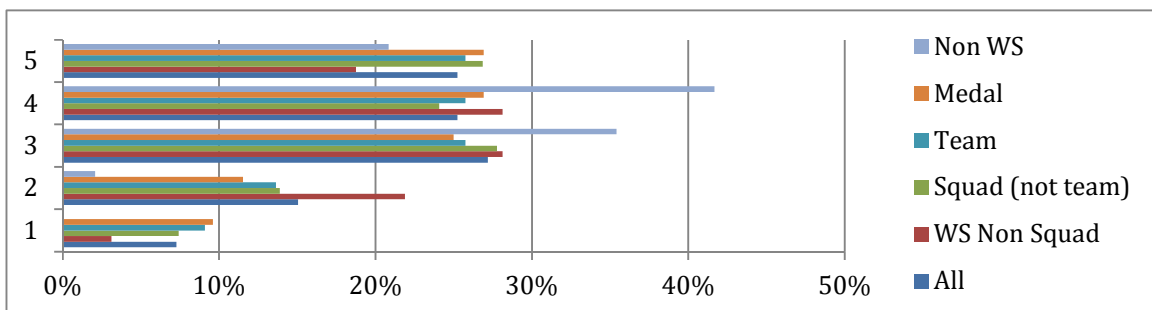
Figure 13: Recognised as a learner



Organisational development

In an expansive learning environment the training/learning is used ‘as a vehicle for aligning the goals of developing the individual and organisational capability’ (Fuller and Unwin, 2003a, 8). For 26% of the team members their goals were embedded in the business goals (21% for Non-WS). This figure is higher for medal winners at 27%. For 26% of WS respondents some account was taken of employees’ goals in relation to the business goals (35% for Non-WS) while 23% of team members (2% for Non-WS) responded that little or no account was taken of their goals. Overall, approximately 77% of the young people reported that their goals were taken into account within the organisation (Figure 14).

Figure 14: Own goals reflected in business goals



Summary

Given the high scores reported by most of the respondents, it is reasonable to assume that these features would be prominent in these organisations considering their involvement in WorldSkills in the first place. However, there were differences, to greater and lesser extents, across the seven areas that we focussed upon. Across the different groups, *Participation and understanding of the workplace*, appeared on the more expansive end of the spectrum where respondents had access to a variety of situations and processes, to colleagues and to understanding the goals and aims of the workplaces. In *Task performance* there was more dispersion. The young people had access to a range of skills, worked with others at the expansive end but were more restricted in terms of solving complex problems and receiving communication and feedback. There was also a mixed picture in the

Availability of resources to help the young people learn area. The responses to having a mentor or coach and access to resources to aid learning was more widely dispersed than the encouragement they received to gain a qualification or the training they received in the workplace, which appear to be at the more expansive end of the continuum. In terms of being able to make *Judgement, decisions, problem solve and reflect* the responses were on the expansive half of the spectrum where assessing own performance, making decisions and solving problems were high; having time to reflect was less expansive. Responses to the questions around *Experience, task transition and career progression* were toward the middle with responses resting in the middle of the expansive-restrictive continuum, particularly where the young person was aware of possible career progression highlighting that opportunities were available but were heavily reliant on the work available. Responses were high for the *Status as a worker and learner* area across all groups. The respondents reported being both acknowledged as a worker in terms of development, achievement and excellence and being expected and encouraged to learn. There was more variation in responses to the final area, *Organisational development*. While the answers were evenly distributed across the scale of answers, the young people not involved in WorldSkills reported having their goals taken into account with the business goals the most.

Although these are reported scores of interpretations, they do nonetheless give insight into the features of these workplaces. Interestingly, while the difference between medal winners, team members and Non-WS respondents are not large for most of the individual questions, as a whole the responses do show these workplaces at different points on the expansive/restrictive continuum. Clearly these areas work together to provide the experiences for the young people to learn. The relationships between these areas is reported in Section 4.

4. The relationship between aspects of the learning environment at work

Applying the three criteria discussed in Section 2, we identify two factors underlying the responses to the survey.⁵ The statistical analysis conducted for these findings appears in Appendix C. Table 7 in Appendix C shows the estimated factor loadings (where loadings below 0.2 are omitted to ease of reading). Factor 1, the most important factor, largely combines responses to do with the work environment, and particularly how the working environment facilitates learning and development. In what follows, we refer to this as ENVIRONMENT. Factor 2 relates most strongly to questions about

⁵ Table 6 shows the eigenvalue (representing variation in the data explained by each factor) falls below 1 for factor 3, so the Kaiser criterion would recommend 2 factors. Figure 15 (Appendix 1) similarly shows that these eigenvalues flatten off after factor 2, again suggesting two factors. As noted previously, the parallel analysis suggests five factors, although it is only a marginal improvement over the 2-factor model, as indicated by how close the factor analysis and parallel analysis lines become at this point.

the complexity and range of task performed at work. We refer to this measure in the remainder of the report as TASK. Each of these variables is computed for all participants of the survey.

4.1 Distribution of ENVIRONMENT and TASK

These two factors are distributed across different subgroups of our survey sample (see Table 8, Appendix C) and highlights a number of key trends:

- The group surveyed from outside the skills competitions (Non-WS) tended to score higher on average than the WS competitors for ENVIRONMENT, but lower for TASK. Without further investigation, it is not clear why these two groups might differ, and if this is related to their participation in skills competitions;
- Team members scored higher for TASK and lower for ENVIRONMENT on average than squad members who did not make the team;
- Medal winners scored lower for both measures, on average, than non-medal winners; and
- There are strong sectoral/skill cluster distinctions (Table 5 below).

Table 5: Distinctions between sector and skill clusters

	Relatively high TASK	Relatively low TASK
Relatively high ENVIRONMENT	ICT Social and personal	Manufacturing and engineering
Relatively low ENVIRONMENT	Construction Transportation	Creative

4.2 World Skills performance

We used the two factors to try to understand how the working environment affects performance in skills competitions. Firstly, we look at the prospects of making the squad from the team. Unlike previous years, the 2013 survey was administered to a group of participants that did not make the squad (Non-squad). We estimate a logit model on the probability of being selected from the squad for the team. The results are shown in Table 9, Appendix C. This analysis shows that although both ENVIRONMENT and TASK scores had a positive effect on the likelihood of progressing to the squad, these effects were not statistically significant. It is possible that the small sample size prevents a stronger finding here and suggests further study is needed.

Our second analysis concentrates on those who made the UK team for WorldSkills in 2009, 2011, and 2013 relative to those who did not. We again estimate a logit model on the probability of being selected from the squad for the team (Table 10, Appendix C). The results can be summarised as follows:

- The prospect of progressing from squad to team did not significantly depend on the year of the competition or the particular skills cluster; and
- Although TASK and ENVIRONMENT did not individually explain why some people made the team and some did not, the combination of the two did make a small but significant effect on

performance. In particular, participants with higher scores for both TASK and ENVIRONMENT performed better. For example, an individual who scored the average level for both ENVIRONMENT and TASK is predicted to make the team with a probability of 30%. An individual who scored one standard deviation higher than the mean on both ENVIRONMENT and TASK would be predicted to make the team with a probability of 38%.

Finally, we performed a similar analysis for the prospect of winning medals once a competitor had made the team, but found no significant effects from either TASK or ENVIRONMENT. We also attempted a “kitchen sink” analysis of medal performance by including all twenty-one individual survey questions. This showed that the two individual questions related to performance were “receives training” (a positive effect) and “experience across the company” (a negative effect) (Table 11, Appendix C). These effects were also found when all the other variables were dropped, as well as various other specifications where additional variables were included. These results point to earlier research (James and Holmes, 2012) that the additional training received by team members in preparation for competing at WorldSkills is more important for performance at World Skills than their previous working experience. Given this later analysis, it is possible that the individuals who respond best to the WorldSkills UK training are also those who are used to receiving formal training in their workplace, which would explain why we find a positive effect link solely to the question around training, and not the more general measure of work environment.

5. Conclusions and recommendations

Within the WSC context, developing vocational excellence involves a number of people: the young person, colleagues in the workplace, and WorldSkills trainers to name a few. The young people competing at a WSC receive a substantial amount of training outside of the workplace to bring their skills levels up to the international standards and the propensity of the young person to take up learning opportunities is obviously a key factor. Yet, clearly the workplace plays a role, even within a group of relatively high achievers. This research focussed solely on the workplace to try and understand its significance in developing vocational excellence. Our research argues that the workplaces involved with WorldSkills are impacting several aspects of performance in skills. The main findings are:

- Aspects of the seven areas of focus work together to help the young person develop their skill and knowledge to a high level and these areas all tend to be on the expansive end of the continuum for these workplaces;
- Team and medal winners scored higher on four particular factors: working with colleagues; understanding the aims and goals of the workplace; using a range of skills in their work; assessing their own performance;

- The prospect of progressing from squad to team did not significantly depend on the year of the competition or the particular skills cluster; however, there are strong sectoral/skill cluster distinctions with regards to the work environment (“ENVIRONMENT”) and the types of tasks performed at work (“TASK”).
- Participants with higher scores for both TASK and ENVIRONMENT showed signs of performing better, in particular in their progression into the squad and then from the squad to the final team;
- Team members scored higher for TASK and lower for ENVIRONMENT on average than squad members who did not make the team. The more expansive the workplace on the two factors combined, the more likely the young person is to make the team. On their own these factors do not make a significant contribution; it is the combination of the environment and support for the young person by the firm with the particular tasks they are engaged in which is key to developing excellence;
- However, medal winners scored lower for both measures, on average, than non-medal winners; and
- The group surveyed from outside the skills competitions (Non-WS) tended to score higher on average than the competitors for ENVIRONMENT, but lower for TASK.

What this research reinforces is that the more ‘expansive’ a workplace (Fuller and Unwin 2003a), on both ENVIRONMENT and TASK measures – the more likely the employee is going to have the necessary and sufficient skill base to begin working towards meeting WorldSkills international standards in that skill and potentially winning a medal.

Acknowledgements

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8. Appendices

Appendix A – Skills clusters of WorldSkills Competitions

Transportation and Logistics

Car painting
Automobile technology
Aircraft maintenance
Autobody repair

Construction and building technology

Stonemasonry
Wall and floor tiling
Plumbing and heating
Electrical installations
Bricklaying
Plastering and drywall systems
Painting and decorating
Cabinetmaking
Joinery
Carpentry
Landscape gardening
Refrigeration

Creative arts and fashion

Floristry
Fashion technology
Graphic design technology
Visual merchandising/window dressing
Jewellery

Manufacturing and engineering technology

Electronics
Industrial control
Polymechanics/automation
Manufacturing team challenge
Mechatronics
Mechanical engineering design – CAD
CNC Turning
CNC Milling
Welding
Mobile robotics
Construction metal work
Sheet metal technology
Prototype modelling
Plastic die engineering

Information and communication technology

Information network cabling
IT software solutions for business
IT network and systems administration
Print media technology
Web design

Social and personal services

Hairdressing
Beauty therapy
Confectionery/pastry cook
Cooking
Restaurant service
Health and social care

Appendix B – Non-WorldSkills participants skill area

Healthcare	Mechanical maintenance
Caring	Mechanical engineering
Business Administration	Mechanical engineering
Change and Configuration Management	Engineering toolmaking
Accountancy	Mechanical engineering
Business Administration	Engineer
Business Administration	Engineering
Business Administration	Mechanical engineering
Administration	Mechanical engineering
Stonemasonry	Engineering
Stonemasonry	Mechanical Engineering
Stonemasonry	Engineering
Stonemasonry	Steel works maintenance
Stonemasonry	Toolmaker
Stonemasonry	Cookery
Stonemasonry	Cookery
Business Administration	Cookery
Business Administration	Cookery
Business Administration	Cookery
Business Administration	Hairdressing
Caring	Hairdressing
Childcare	Hairdressing
Childcare	
Childcare	
Childcare	
Childcare	
Childcare	
Childcare	
Childcare	
Childcare	

N = 51

Appendix C – Factor analysis methodology

Table 6: Factor analysis. Note: Kaiser criterion identifies 2 factors, as the third factor has an eigenvalue less than one.

Factor	Eigenvalue	Difference	Proportion of variance explained	Cumulative variance explained	Parallel Analysis
Factor 1	6.052	4.040	0.688	0.688	0.612
Factor 2	2.012	1.335	0.229	0.916	0.506
Factor 3	0.677	0.203	0.077	0.993	0.427
Factor 4	0.474	0.096	0.054	1.047	0.357
Factor 5	0.378	0.155	0.043	1.090	0.302
Factor 6	0.223	0.074	0.025	1.115	0.254
Factor 7	0.149	0.050	0.017	1.132	0.207
Factor 8	0.099	0.025	0.011	1.144	0.159
Factor 9	0.074	0.048	0.008	1.152	0.112
Factor 10	0.027	0.022	0.003	1.155	0.055
Factor 11	0.004	0.018	0.001	1.156	0.017
Factor 12	-0.014	0.072	-0.002	1.154	-0.022
Factor 13	-0.086	0.010	-0.010	1.144	-0.055
Factor 14	-0.096	0.031	-0.011	1.133	-0.097
Factor 15	-0.127	0.010	-0.014	1.119	-0.128
Factor 16	-0.137	0.046	-0.016	1.103	-0.163
Factor 17	-0.183	0.017	-0.021	1.083	-0.207
Factor 18	-0.201	0.048	-0.023	1.060	-0.253
Factor 19	-0.249	0.028	-0.028	1.031	-0.290
Factor 20	-0.276	.	-0.031	1.000	-0.346

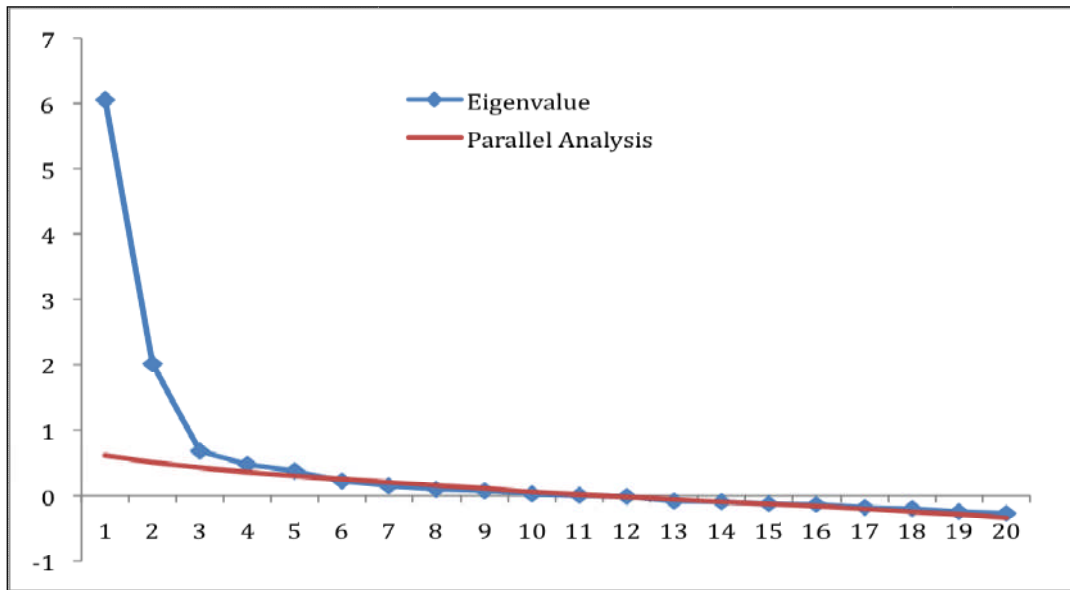


Figure 15: Scree plot of eigenvalues of factor analysis and Parallel Analysis. Note: the scree plot indicates using two factors (as the eigenvalues plateau after factor 3. The Parallel Analysis suggests using five factors, as this is the point where the factor analysis eigenvalue falls below the parallel analysis eigenvalue. The figure shows how marginal this is beyond factor 2.

Table 7: Factor loadings and labels

Factor loadings - 2 factors	Factor 1	Factor 2
competitor: 1a variety of situations and processes		0.4739
competitor: 1b work with colleagues	0.3464	
competitor: 1c understand workplace goals and aims	0.4147	0.3159
competitor: 2a tackle complex problems		0.6799
competitor: 2b use a range of skills	0.2348	0.6168
competitor: 2c work with others	0.5709	
competitor: 2d receive communication and feedback	0.7385	
competitor: 3a have mentor or coach	0.6356	
competitor: 3b access to learning resources	0.6622	0.208
competitor: 3c encourage to gain qualifications	0.5238	
competitor: 3d receive training	0.6634	
competitor: 4a assess own performance	0.3324	0.3704
competitor: 4b make decisions		0.7718
competitor: 4c solve problems		0.7615
competitor: 4d time to reflect	0.4962	0.3357
competitor: 5a experience across company	0.5815	0.2214
competitor: 5b work through tasks	0.6065	0.3586
competitor: 5c aware of career progression	0.6123	0.2563
competitor: 6a work acknowledged	0.6601	
competitor: 6b recognised as learner	0.6376	
<i>Label</i>	ENVIRONMENT	TASK

Table 8: Distribution of TASK and ENVIRONMENT

Group	n	Environment	Task
World Skills competitors	218	-0.080	0.088
Non-WS	50	0.350	-0.386
<i>Not including non-WS group:</i>			
Not team	148	-0.065	0.037
Team	70	-0.112	0.197
<i>Only including team:</i>			
Not medal	14	0.380	0.409
Medal	56	0.149	0.144
<i>2013 only, not including non-WS group:</i>			
Not squad	32	-0.122	-0.338
Squad	67	0.053	-0.080
<i>Not including control group:</i>			
2009	55	-0.086	0.165
2011	64	-0.194	0.412
2013	99	-0.003	-0.163
<i>Skill clusters:</i>			
Manufacturing	45	0.080	-0.370
ICT	6	0.312	0.318
Social and personal	33	0.350	0.078
Transportation	20	-0.291	0.199
Construction	90	-0.281	0.371
Creative	24	-0.140	-0.247

Table 9: Logit regression of probability of making the squad.

Environment		0.175 (0.49)	0.085 (0.75)	0.019 (0.95)
Task		0.205 (0.36)	0.300 (0.24)	0.237 (0.37)
Environment * Task				-0.306 (0.20)
+ Skill cluster dummies	n.s.		n.s.	n.s.
N	101	99	97	97
Pseudo R ²	0.02	0.01	0.03	0.04
F-test	Not significant	Not significant	Not significant	Not significant

Note: ** = significant at 5% level; n.s. = not significant at 10% level.

Table 10: Logit regression of probability of making the team from the squad.

Environment			-0.006 (0.97)	-0.173 (0.35)	-0.240 (0.18)
Task			-0.001 (0.995)	0.097 (0.627)	0.183 (0.33)
Environment * Task				0.511** (0.02)	0.526** (0.02)
+ Year dummies	n.s.	n.s.	n.s.	n.s.	
+ Skill cluster dummies		n.s.	n.s.	n.s.	
N	194	194	186	186	186
Pseudo R ²	0.01	0.01	0.02	0.04	0.03
F-test	Not significant	Not significant	Not significant	Not significant	Jointly significant

Note: ** = significant at 5% level; n.s. = not significant at 10% level.

Table 11: Logit regression of probability of a team member gaining a medal

Receives training		2.691** (0.049)	0.803** (0.01)
Experience across the company		-2.624* (0.081)	-1.235** (0.004)
+ Other survey questions		n.s.	
+ Year dummies	n.s.		n.s.
N	75	62	72
Pseudo R ²	0.04	0.45	0.23
F-test	Not significant	Not significant	Jointly significant

Note: ** = significant at 5% level; * = significant at 10% level; n.s. = not significant at 10% level.

Table 12: Correlation between competitor and employer survey responses

Question	Chi2 test	Cramer's V	Pearson correlation
competitor: 1a variety of situations and processes	Independent	0.338	0.021
competitor: 1b work with colleagues	Independent	0.326	0.071
competitor: 1c understand workplace goals and aims	Independent	0.387	0.020
competitor: 2a tackle complex problems	Independent	0.202	0.139
competitor: 2b use a range of skills	Not independent	0.508	0.271
competitor: 2c work with others	independent	0.511	0.307
competitor: 2d receive communication and feedback	Independent	0.257	0.018
competitor: 3a have mentor or coach	independent	0.516	-0.014
competitor: 3b access to learning resources	Independent	0.360	0.136
competitor: 3c encourage to gain qualifications	independent	0.590	0.401
competitor: 3d receive training	independent	0.500	0.251
competitor: 4a assess own performance	Independent	0.317	0.208
competitor: 4b make decisions	Independent	0.391	0.384
competitor: 4c solve problems	Independent	0.236	0.179
competitor: 4d time to reflect	independent	0.508	-0.064
competitor: 5a experience across company	Independent	0.482	0.084
competitor: 5b work through tasks	Independent	0.227	0.014
competitor: 5c aware of career progression	independent	0.542	0.412
competitor: 6a work acknowledged	Independent	0.379	0.130
competitor: 6b recognised as learner	Independent	0.344	0.169