worldskills

Technical Description

Software Applications Development

Skill 09

WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders, and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

1 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

Software Applications Development

1.1.2 Description of the associated work role(s) or occupation(s)

The rapid pace of globalization over the past decade has been largely driven by developments in Information and Communication Technology (ICT). IT specialists are increasingly in demand in several areas, one of which is providing software solutions for businesses.

The development of software solutions to improve business productivity encompasses many different skills and disciplines. Key to these is an awareness of the fast-changing nature of the industry and the ability to keep up with the rapid pace of change.

Software Developers are professionals represent a wide spectrum such as computer programmers, solution architects, and full stack developers. They always work closely with clients to modify existing systems or create new systems. They may modify “off-the shelf” software and integrate it into the existing systems. They often work as part of a team of software professionals responsible for software specification, writing algorithms, design software systems, testing, and implementation, as well as maintenance of a business software system. Their work is often more orientated towards the backend.

The tasks performed by software application developers include but are not limited to the following:

- Review current system and present ideas for improvement, including cost benefit analysis
- Produce detailed specifications for new systems or for modifications to existing systems
- Develop software systems and test the software solution thoroughly
- Provide solutions according to the specific requirements of each enterprise
- Implement, deploy and maintain software systems
- Test the software interfaces.

Software Developers can be employed in large, medium, and small enterprises as software engineers, computer programmers, solution architects and full-stack developers, in consulting firms as consultants, and in software houses as contractors.

They can operate in a wide variety of roles to handle end-to-end use cases, including frontend-backend developer, software engineer in test, development and operations, technical lead or solution architect.

1.1.3 Number of Competitors per team

Software Applications Development is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 22 years in the year of the Competition.

1.2 The relevance and significance of this document

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods, and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

Since this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI – Code of Ethics and Conduct
- WSI – Competition Rules
- WSI – WorldSkills Occupational Standards framework
- WSI – WorldSkills Assessment Strategy
- WSI online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations
- WorldSkills Standards and Assessment Guide (skill-specific)

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

The WSOS specifies the knowledge, understanding, skills, and capabilities that underpin international best practice in technical and vocational performance. These are both specific to an occupational role and also transversal. Together they should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, to the extent that it can. The Standard is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the “weighting”. The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills and capabilities that are set out in the WorldSkills Occupational Standards. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, if this does not distort the weightings assigned by the Standards.

2.2 WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	**5**
	The individual needs to know and understand: • The principles and practices that enable productive teamwork • The principles and behaviour of systems • The aspects of systems that contribute to sustainable products, strategies, and practices • How to take initiatives and be enterprising in order to identify, analyze, and evaluate information from a variety of sources • The importance of sustainability in the workplace because it can: ◦ Unite staff to create a better work culture, ◦ Increase employee productivity ◦ Lessen work-related illnesses	

Section		Relative importance (%)
	◦ Improve the health of the planet, and ◦ Earn customers' trust.	
	The individual shall be able to: • Plan each day's production schedule according to available time and take into account time limitations and deadlines • Apply research techniques and skills to keep up-to-date with the latest industry guidelines • Review own performance against the expectations and needs of clients and organizations • Work within the sustainability guidelines expected by the clients and organizations.	
2	**Communication and interpersonal skills**	**5**
	The individual needs to know and understand: • The importance of listening skills • The necessity of using discretion and confidentiality when dealing with clients • The importance of resolving misunderstandings and conflicting demands • The importance of establishing and maintaining customer confidence and productive working relationships • The value of written and oral communication skills • The importance of thoroughly documenting developed solutions.	
	The individual shall be able to: • Use literacy skills to: ◦ Follow documented instructions from supplied guides ◦ Interpret workplace instructions and other technical documents ◦ Interpret and understand systems specification documents ◦ Keep up-to-date with latest industry guidelines • Use oral communication skills to: ◦ Discuss and offer suggestions regarding system specifications ◦ Keep clients updated regarding systems' progress ◦ Negotiate with clients regarding project budgets and timelines ◦ Gather and confirm clients' requirements ◦ Present proposed and final software solutions • Use written communications skills to: ◦ Document and demonstrate solutions by developing documentation, flowcharts, layouts, diagrams, charts, code comments and clear code. ◦ Keep clients updated regarding systems' progress ◦ Confirm that created applications meet original specifications and obtain user sign-off for completed systems	

Section		Relative importance (%)
	• Use team communication skills to: ◦ Collaborate with others to develop required outcomes ◦ Contribute to group problem solving • Use project management skills to: ◦ Prioritize and schedule tasks ◦ Allocate resources to tasks.	
3	**Problem solving, innovation, and creativity**	**10**
	The individual needs to know and understand: • The common types of problem which may occur within software development • The common types of problem which may occur within a business organization • Diagnostic approaches to problem solving • Trends and developments in the industry including new platforms, languages, conventions, and technical skills.	
	The individual shall be able to: • Use analytical skills to: ◦ Synthesize complex or diverse information ◦ Determine the functional and non-functional requirements of specifications • Use investigation and learning skills to: ◦ Obtain user requirements (e.g. interviews, questionnaire, document search and analysis, joint application design, and observation) ◦ Research encountered problems independently • Use problem-solving skills to: ◦ Identify and resolve problems in a timely manner ◦ Gather and analyze information skilfully ◦ Develop alternatives for decision making, select the most appropriate alternatives and produce the required solutions ◦ Develop business logic and computational algorithms for specific tasks.	
4	**Analysis and design of software solutions**	**15**
	The individual needs to know and understand: • The importance of considering all possible options and deriving the best solution based on sound analytical judgment and clients' best interests • The importance of using system analysis and design methodologies (e.g. Unified Modelling Language, Model-View-Control (MVC) software framework, Design Patterns, C4 Model)	

Section		Relative importance (%)
	• The need to be up to date with new technologies and able to make judgements about the appropriateness of adopting them • The importance of optimizing systems design with an emphasis on modularity and reusability • The importance of the full software development life cycle, including coding standards, code reviews, source control management, build processes, testing, and operations.	
	The individual shall be able to: • Analyze systems using: ◦ Use Case modelling and analysis (e.g. Use Case Diagram, Use Case Description, Actor Description, Use Case Package) ◦ Structural modelling and analysis (e.g. Object, Class, Domain Class Diagram) ◦ Dynamic modelling and analysis (e.g. Sequence Diagram, Collaboration Diagram, State Diagram, Activity Diagram) ◦ Data modelling tools and techniques (e.g. Entity Relationship Diagram, Normalization, Data Dictionary) • Design systems using: ◦ C4 Model: System Context – Container – Component Diagram and System Landscape Diagram ◦ Wireframe for UI and UX concepts ◦ Application Interface (API) ◦ Relational database design ◦ Human-computer interface design ◦ Security and controls design.	
5	**Development of software solutions**	**50**
	The individual needs to know and understand: • The importance of considering all possible options and deriving the best solutions to meet user requirements and clients' best interests • The importance of using system development methodologies (e.g. object-oriented technology) • The importance of considering all normal and abnormal scenarios, and exception handlings • The importance of following standards (e.g. code convention, style guide, user interface designs, managing directories, and files) • The importance of accurate and consistent version control • The use of existing codes as a basis for analysis and modifications • The importance of selecting the most appropriate development tools from the available options.	

Section		Relative importance (%)
	The individual shall be able to: • Develop software solutions by studying information needs, conferring with users, and studying systems flow, data usage, and work processes • Use database management systems to construct, store and manage the data for the required systems • Use latest software development environments and tools to modify existing codes and write new codes of client-server-based software solutions • Evaluate and integrate appropriate libraries and frameworks into the software solutions • Build multi-tier applications • Construct Native Windows-based or Native Android-based interfaces (Using Native Development Technology or Cross-platform Technology) for client- server-based systems.	
6	**Testing software solutions**	**15**
	The individual needs to know and understand: • Troubleshooting methods for common software applications problems • The importance of thoroughly tested solutions • The importance of documenting testing.	
	The individual shall be able to: • Plan testing activities (e.g. unit testing, integration testing, acceptance testing, and volume testing) • Design test cases with data and check results of test cases • Implement black and white box testing.	
	Total	**100**

3 The Assessment Strategy and Specification

3.1 General guidance

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: Measurement and Judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, to demonstrate their quality and conformity with the Standards.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

4 Assessment Design and Practice

4.1 General guidance

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more Independent Test Project Designer(s) with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance. Please see the Competition Rules for further details.

Experts and Independent Test Project Designers are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition. Skill Advisors actively facilitate this process.

4.2 Assessment Criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). **The Assessment Criteria, the allocation of marks, and the assessment methods, should not be set out within this Technical Description. This is because the Criteria, allocation of marks, and assessment**

methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published.

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

4.3 Sub Criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by Measurement or Judgement, or both Measurement and Judgement.

Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

4.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by Measurement or by Judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

		CRITERIA								TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE
		A	B	C	D	E	F	G	H			
STANDARDS SPECIFICATION SECTION	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		9.50	10.00	0.50
	3								11.00	11.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS		5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by Judgement, Measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

4.6 Assessment and marking using Judgement

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, Judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts, or separate guidance notes). This is documented in the Standards and Assessment Guide.
- the 0-3 scale to indicate:
  - 0: performance below industry standard
  - 1: performance meets industry standard
  - 2: performance meets and, in specific respects, exceeds industry standard
  - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

4.7 Assessment and marking using Measurement

Normally three Experts will be used to assess each Aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

4.8 The use of Measurement and Judgement

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

4.9 Skill assessment strategy and procedures

WorldSkills is committed to continuous improvement including reviewing past limitations and building on good practice. The following skill assessment strategy and procedures for this skill competition take this into account and explain how the marking process will be managed.

Marking groups are formed in accordance with the Competition Rules.

The skill assessment criteria developed by the Independent Test Project Designer are clear concise aspect specifications which explain exactly how and why a particular mark is awarded.

There can be three different types of measurement criteria in the Test Project. The table below shows an explanation of the three types:

Type	Example	Max. Marks	Correct	Not Correct
Full marks or zero marks	The pie chart shows data labels as percentages	0.20	0.20	0

Type	Example	Max. Marks	Correct	Not Correct
Deduct from full marks on a predetermined sliding scale	Report is formatted as specified (deduct 0.1 mark for each error)	0.5	0.5	0 – 0.4
Add to zero marks on a predetermined progressive scale	Solver criteria specified correctly (add 0.1 mark for each criterion)	1.0	1.0	0.0 – 0.9

The marking process should prioritize recognizing the achievements of Competitors rather than penalizing omissions. At least 80% of the approach should employ the 'Add to Zero Marks' method on a predetermined progressive scale when necessary.

Ensure that the total deductions in the deductive marking process do not exceed the maximum points available.

Each Expert at the Competition is eligible to serve as a member of the marking team for the Test Project, contingent upon the completion of all mandatory preparations. The Skill Competition Manager and the Chief Expert will determine both the composition of the marking teams and the proportion of marks each team is responsible for. The Chief Expert's involvement in the marking process remains optional.

Experts are divided into different cultural groups for marking where possible.

The Independent Test Project Designer will provide the marking criteria. Experts will discuss these marking criteria upon arrival at the Competition.

5 The Test Project

5.1 General notes

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS.

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Standards will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Standards or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work. The Test Project will not assess knowledge of WorldSkills rules and regulations.

Most Test Projects and Marking Schemes are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Designer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

Please refer to the current version of the Competition Rules for further details.

5.2 Format/structure of the Test Project

The Test Project/modules are in the form of a case study that will represent typical functions that might be asked of a software developer who is highly competent in the skills described. The Test Project consists of seven (7) sessions with a duration of 2.5-3 hours per session.

The scenario is presented as a project with clearly defined deliverables. These deliverables are grouped to enable a modular approach whereby discrete tasks can be completed in a session. The Competitors will select the appropriate component(s) of the software for the task. Where applicable, all deliverables must be conformed to the industry standard. That means they must include readme or documentation files and must be given as copy deployments or similar solutions, e.g. using installation programmes as usually in customer environments.

Common data files are provided in English only and only an English version of the software is provided.

5.3 Test Project design requirements

Test Projects should reflect the purposes, structures, processes, and outcomes of the occupational role they are based on. They should aim to be a small-scale version of that role. Before focusing on practicalities, SMTs should show how the Test Project design will provide full, balanced, and

authentic opportunities for assessment and marking across the Standards, as set out in Section 5.1.

5.3.1 Project fundamentals and scope

The Test Project must authentically represent real-world IT software solutions, functioning as a concentrated version of actual business scenarios. Before addressing practical implementation, SMTs must demonstrate how the Test Project design will provide comprehensive, balanced, and authentic assessment opportunities across the Standards outlined in Section 5.1.

The project should simulate comprehensive workplace activities in IT, encompassing various aspects of information gathering, processing, and distribution. While industry-specific knowledge should not be required, the project should ideally address genuine needs of charitable or non-profit organizations in the Host Country to ensure meaningful resource utilization. Sponsorship or support from a representative within the Competition Organizer is recommended.

Each session's work must be assessable upon completion. For tasks spanning multiple sessions, Competitors' work must be backed up for marking at the end of each session. For example, in database development tasks involving table definitions, data imports, and report construction, specific deliverables must be completed within the first session. These solutions are backed up and marked at the break, with subsequent modifications excluded from evaluation. Marks will be allocated according to the WorldSkills Occupational Standards in section 2, and the marking scheme will follow section 4's instructions.

5.3.2 Technical framework and environment

The project implementation must accommodate multiple platforms and form factors, including desktop and mobile solutions, utilizing the following technology stack:

Programming languages and frameworks

- C# and ASP.NET (.NET Framework and Core)
- Python
- Additional frameworks/libraries to be confirmed at C-12 months

Development environments

- Visual Studio
- Visual Studio Code
- Notepad++
- Android Studio

Database systems

- MS SQL Server
- MySQL

Productivity and visualization tools

- MS Office Suite
- MS Visio
- Draw.io (Offline Installation)

The specific software versions will be documented in the Infrastructure List, determined through collaboration between the Skill Competition Manager and Workshop Manager during Competition

Preparation Week. Technology stack updates may occur at the C-12 deadline to maintain currency and relevance.

The software versions used at the Competition will be listed in the Infrastructure List following a discussion between the Skill Competition Manager and Workshop Manager at Competition Preparation Week.

5.3.3 Project management and delivery

The independent Test Project design team's responsibilities encompass:

- Developing comprehensive case study scenarios
- Documenting system deliverables and specifications
- Providing test data and suggested solutions
- Establishing marking criteria aligned with Technical Description and CIS
- Creating style guides and project overviews
- Coordinating network infrastructure requirements
- Managing Git repository implementation

The number of sessions, types, categories, and session break-up will be discussed with the Independent Test Project Designer on the WorldSkills Discussion Forum before project initialization. All registered and former Experts may submit an "Expression of Interest" to nominate individuals or organizations for the Independent Test Project design team. Nominations must be emailed to the SCM, who will review and select candidates in consultation with the WSI Secretariat.

The design team members *will communicate exclusively* with the Skill Competition Manager and *must maintain no contact with Experts*. Each Expert must submit sample references through the WorldSkills Discussion Forum within the Skill Competition Manager's stipulated timeframe, including reports and reviews about previous Competition Test Projects, marking, and data files.

A prototype environment (VM/Cloud/Docker) will be decided during Competition Preparation Week (CPW). All Experts can access this training resource at least three months before the Competition via the WorldSkills Discussion Forums, with the finalized version available one month prior to the Competition. The "Network Guide," developed collaboratively between the Workshop Manager and Skill Competition Manager, must be distributed to all Experts one month before the Competition through the WorldSkills Discussion Forum.

5.4 Test Project coordination and development

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Test Project coordination (preparation for Competition)

Coordination of the Test Project/modules will be undertaken by the Skill Competition Manager.

5.4.2 Who develops the Test Project/modules

The Test Project/modules are developed by an Independent Test Project Designer (ITPD) in collaboration with the Skill Competition Manager.

5.4.3 When is the Test Project developed

The Test Project/modules are developed according to the following timeline:

Time	Action
Six (6) months after the last Competition	• Each Expert must submit a review and feedback of the previous Competition's Test Project, including marking guide, to help improve the quality of the next Test Project.
Fifteen (15) months prior to the Competition	• The ITPD is identified and a Confidentiality Agreement between WSI and the ITPD is organized.
Two (2) months prior to the Competition	• The Test Project documents are sent to the WorldSkills Skills Competitions Administration Manager. • The information on image software (VM)/docker images is distributed via the WorldSkills Discussion Forum.
One (1) month prior to the Competition	• The Style Guidelines and "Test Project Overview" are circulated on the WorldSkills website. • The Workshop Manager should make the final VM to be used on the competition available on the WorldSkills Discussion Forum. • The Network Guide is also put together by the Workshop Manager and is made available to all the Experts via the WorldSkills Discussion Forum.
At the Competition on C-4	The Test Project/modules are presented to Experts.
At the Competition on C1	The Test Project/modules are presented to Competitors.

5.5 Test Project initial review and verification

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations.

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer (ITPD) is expected to identify one or more independent expert(s), and trusted individuals initially to review the Independent Test Project Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

5.6 Test Project validation

The Skill Competition Manager coordinates the validation of the Test Project/modules and will ensure that it can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project circulation

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Experts on C-4 and to Competitors on C1.

Generic Competitor pre-competition information and the Style Guidelines are circulated on the WorldSkills website one (1) month prior to the Competition. No technical or detailed information on the Test Project/modules is shared.

5.8 Test Project change

Due to the Test Project being developed by an Independent Test Project Designer (ITPD), there is no change required to be made to the Test Project/modules at the Competition. Exceptions are amendments to technical errors in the Test Project documents and according to infrastructure limitations.

5.9 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

6 Skill management and communication

6.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the WorldSkills skill-specific Discussion Forum. (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the WorldSkills Discussion Forum. The Chief Expert (or an Expert Lead appointed by the Skill Management Team) will be the moderator for this Discussion Forum. Refer to the Competition Rules for the timeline of communication and competition development requirements.

6.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

This information includes:

- Competition Rules
- Technical Descriptions
- Mark Summary Form (where applicable)
- Test Projects (where applicable)
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 Test Projects and Marking Schemes

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 Day-to-day management

The day-to-day management of the skill competition during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and the Expert Leads. The Skill Management Plan is progressively developed in the six (6) months prior to the Competition and finalized at the Competition. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

6.5 General best practice procedures

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

Topic/task	Best practice procedure
Use of technology – personal laptops, tablets, and mobile phones	• Those who require computers for their translations need to notify the Workshop Manager before arrival so they can be accommodated.
Software (language)	• Competitors can only use the software in English. • The Interpreters may not be asked to translate any part of the software or related documentation.
Listening to music while competing	• On Familiarization Day (C-2) Competitors are allowed to supply a memory stick containing a maximum of 30 songs. All music is collated, verified, and shared/streamed amongst all Competitors. • The music streaming/sharing service may be stopped if at any stage, if the Competition Organizers feel that it will affect the performance or integrity of the competitions. • Each Competitor may bring one wired headphone/headset that utilizes the standard headphone jack. They will need to be approved by the Chief Expert, and Workshop Manager before the start of the competition.
Translation of Test Project	• Priority should be given to using AI/machine translation tools provided by WorldSkills International when available at the competition. • In cases where AI/machine translation services are not accessible, Experts requesting translations will receive a software-based pre-translated version. Translation time will be strictly managed, with 60 minutes allocated for sessions less than three hours, and 90 minutes for sessions exceeding three hours. The total translation time for the entire Test Project will be capped at 8:30 hours. Interpreters may utilize translation devices and laptops with internet access to assist with the translation process.

7 Skill-specific safety requirements

7.1 Personal Protective Equipment

Refer to WorldSkills Safety Policy and Regulations for Host country or region regulations.

Task	Sturdy shoes with closed toe and no heel
General PPE for safe areas	√

8 Materials and equipment

8.1 Infrastructure List

The Infrastructure List details all equipment, materials, and facilities provided by the Competition Organizer.

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These items may include those for fault finding modules or modules not circulated.

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition for the upcoming WorldSkills Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

8.2 Competitors toolbox

Competitors are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

8.3 Materials, equipment, and tools supplied by Competitors

It is not applicable for Competitors to send materials, equipment, and tools to the Competition. However, Competitors are allowed to bring a keyboard, a mouse, and/or their headphones.

8.4 Materials, equipment, and tools supplied by Experts

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

Experts are responsible that Interpreters bring their own PPE.

8.5 Materials and equipment prohibited in the skill area

Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4.

The Competitor may definitely not bring:

- Additional software;
- Any portable communications devices such as mobile phones or smart watches;
- Portable digital devices (Tablet, PDAs, etc.);

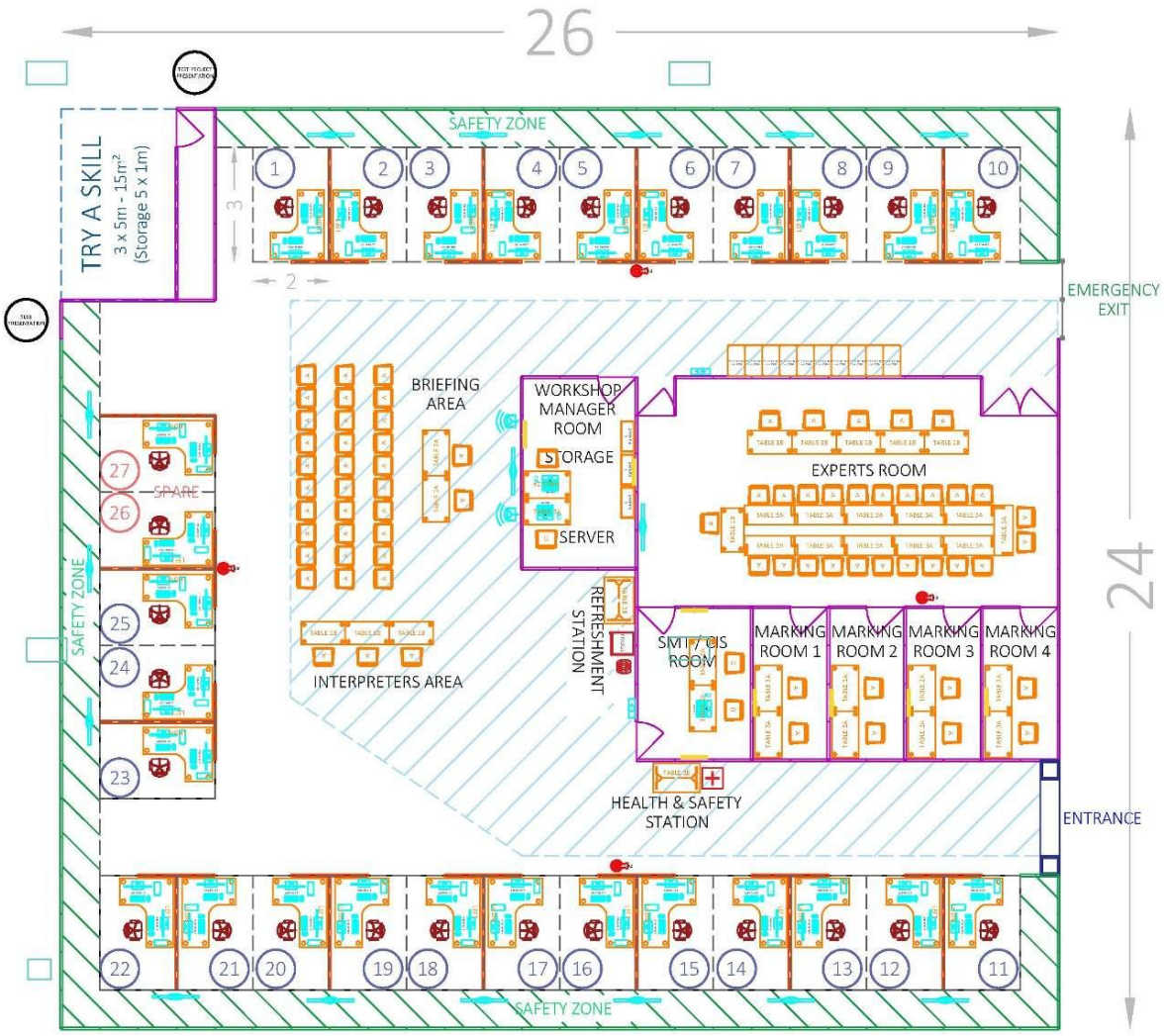
- External storage devices (memory sticks, flash drives, etc.);
- Equipment must not have any access to the internal memory storage devices. The Competition Organizer will ensure that these are disabled;
- The group of Experts hold the right to disallow certain equipment brought into the Competition. That needs to be agreed by a ballot.

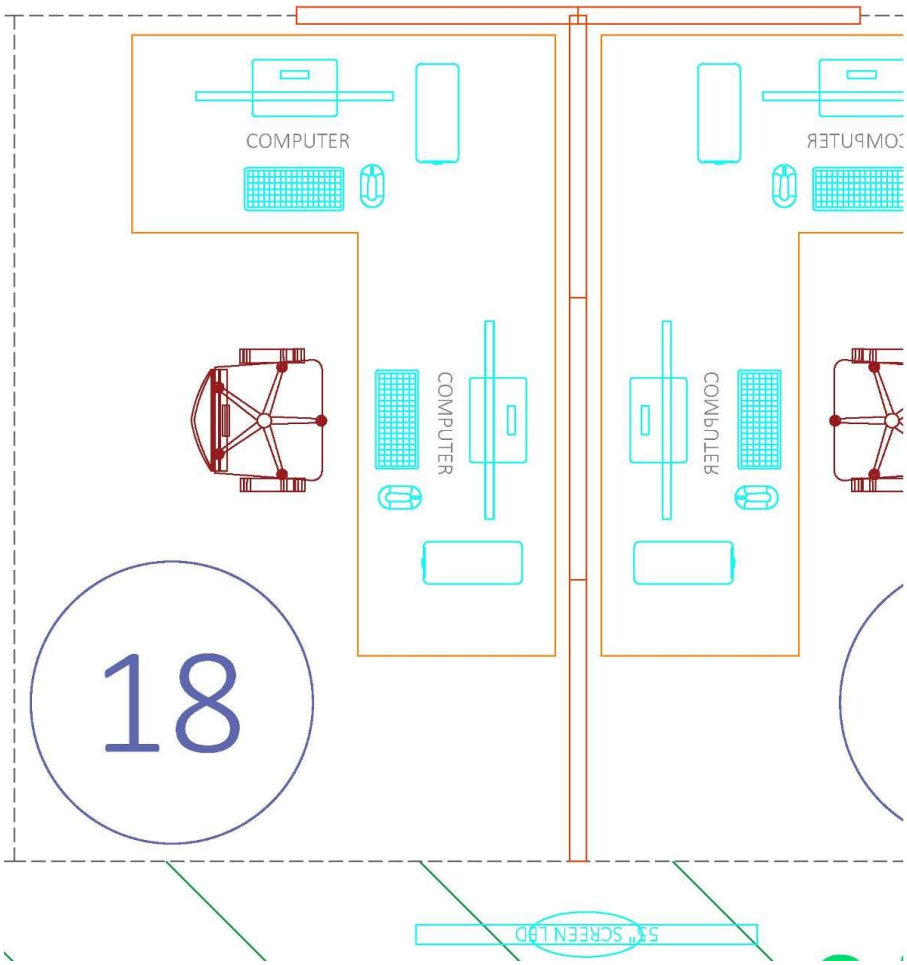
8.6 Proposed workshop and workstation layouts

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout

- An open design of the skill layout is recommended, which guarantees the privacy of each Competitor and considers the need for ease of supervision by the Experts. It must be readily apparent should a Competitor have a need to call an Expert;
- If walls between the competitors were installed, the height of the walls between the two Competitors **must not be more than 120 cm**;
- The design should consider the requirements for maximizing sustainability;
- In case of the need for attention by the Competitor, a centralized buzzer system for each Competitor must be installed.
- The Competitor's display should be presented to the visitors;
- There must be at least four separate and secure marking rooms, if possible, for Experts with adequate space (possible for five Experts to sit in a line) to accommodate a marking team. Each marking team is provided with the room key to secure the marking process;
- There should be secure rooms for the Skill Competition Manager and the Chief Expert to enable them to manage the skill competition;
- A well-equipped Competitor briefing area is required. This must have a projector, screen, and PA system with an easy-to-use computer, audio, video, and other capabilities.
- For time-keeping, ensure the availability of three stopwatches with timer functionality.





9 Skill-specific rules

9.1 General notes

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

9.2 Skill-specific rules

Topic/task	Skill-specific rule
Use of technology – personal laptops, tablets and mobile phones	• Experts and Interpreters are allowed to use personal laptops, tablets, or mobile phones in the Experts room, except when there are documents or discussions relevant to the competition in the room. This applies from C-4 until the end of competition on C4. • The Skill Competition Manager andChief Expert, along with the WM, may hold onto their communication devices at all times. • The use of personal laptops and other communication devices while marking or translating are prohibited. • The Interpreters and Experts may only use laptops or computers supplied by the Competition Organizers to help with their translations. Such devices will not have access to the Internet. Connecting or using any personal communication or storage devices to these computers are not allowed.
Use of technology – personal photo, audio and video taking devices	• Experts and Interpreters are allowed to use personal photo, audio, and video taking devices in the Experts room, except when there are documents or discussions relevant to the competition in the room. This applies from C-4 until the end of competition on C4. • Competitors, Experts, and Interpreters are allowed to use personal photo, audio, and video taking devices in the workshop at the conclusion of the competition only. • Skill Competition Manager, Chief Expert, and Workshop Manager are exempt from this rule.
Use of Internet	• The Competitors may be allowed Internet access in the Competition area. This is on designated computers and is limited to one 10-minute block per Competitor per session on a first come, first served basis. This time is to be included in the competition time.

10 Expert knowledge and experience

10.1 Requirements

Experts appointed for this skill competition must have the following knowledge and experience for the appropriate occupation or work role as documented in **section 1.1.2**.

Summary
Experts appointed to this skill competition must demonstrate strong knowledge and practical experience in software applications development, aligned with the WorldSkills Occupational Standards. They must be able to assess competitors' performance objectively, ensure adherence to industry standards, and contribute to the fair and consistent running of the competition.

Required knowledge and skills

- Comprehensive understanding of the full software development life cycle, including:
  - Systems analysis and design (e.g. UML, MVC, design patterns, C4 model)
  - Development methodologies (object-oriented, agile practices, version control)
  - Testing methodologies (unit, integration, acceptance, black/white box testing)
  - Deployment and maintenance processes
- Proficiency in multiple programming languages and environments, such as:
  - C# and ASP.NET (.NET Framework and Core)
  - Python
  - SQL-based database systems (MS SQL Server, MySQL)
- Ability to evaluate solutions across frontend, backend, and full-stack contexts, including UI/UX, APIs, and security aspects.
- Knowledge of current industry standards, coding conventions, and sustainable development practices.
- Skills in assessing problem-solving, creativity, and innovation in software development tasks.
- Strong competence in project documentation, communication, and technical reporting.
- Familiarity with WorldSkills assessment methods, including both measurement and judgement marking.
- Fluency to communicate in English independently
- Commitment to building long-term professional relationships and actively contributing to the international Skill 9 family.

Required background

- Higher education in computer science, software engineering, or a related ICT field, or equivalent industry qualifications.
- Professional experience in software development roles such as software engineer, solution architect, full-stack developer, or equivalent.
- Proven experience in teaching, training, mentoring, or supervising software development projects.
- Experience in applying occupational or industry standards in assessment or quality assurance contexts.

Valuable additional experience

- Previous involvement in national or international skills competitions as an Expert, trainer, or Competitor.
- Familiarity with vocational education and training systems.
- Knowledge of emerging technologies (e.g. cloud services, DevOps, AI integration, mobile app frameworks).
- Experience with collaborative platforms (Git, cloud-based project management tools).
- Intercultural competence and experience working in international teams.

11 Visitor and media engagement

11.1 Engagement methods

Following is a list of possible ways to maximize visitor and media engagement:

- Competitors' displays are to be showcased to visitors;
- The Test Project descriptions should be presented to the audience through large screens;
- Enhanced understanding of Competitor activity;
- Competitor profiles to be introduced;
- Career opportunities to be highlighted;
- Speed programming is an optional session that may be held on the last day of the competition, after the seventh session. This session is for fun and visitor engagement only, and does not require an Independent Test Project Designer or marking scheme. Participants will receive certificates, medals, and prizes provided by the Skill Management Team of Software Applications Development.

12 Sustainability

12.1 Sustainable practices

This skill competition will focus on the sustainable practices below:

- Recycling and avoiding waste and debris where possible;
- Use of environmentally friendly materials;
- Use of completed Test Projects after the Competition;
- Use of a pdf writer rather than printing.
- Maintaining personal physical and mental health by participating actively in skill specific activities during breaks and between competition sessions

13 References for industry consultation

13.1 General notes

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.onetonline.org/)

13.2 References

This WSOS relates most closely to Software Developers, Applications
https://www.onetonline.org/link/summary/15-1132.00

and Software Developers
http://data.europa.eu/esco/occupation/f2b15a0e-e65a-438a-affb-29b9d50b77d1.

ILO 2512

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2026.

Organization	Contact name
MargiSistemas	Reginaldo Reis de Santana, Senior Product Manager
Neusoft Group	Dave Zhang, CEO
Symas Design Gmbh	Thomas Kehl, CEO

14 Appendix

14.1 Appendix information

Not applicable.