Audit Report
On the

Marking Schemes and Procedures
Used to determine the result of
World Skill Competitions

Objective:

To check the techniques, procedures and tools used to mark competitor work, process results and calculate final scores.

Important note:

The auditor would wish to make it clear that there may be erroneous comment in this report due to the short notice (one day) to undertake the task and inexperience with the software and procedures involved.

1. Items to be checked:

1.1. The facilities offered by the software, ease of use and effectiveness in meeting identified needs.

1.2. Problems experienced with the two types of software available.

1.3. The security procedures in place to enable recovery from a system crash with the minimum of effort.

1.4. The verification procedures used to check the data entry of results.

1.5. The validation procedures used to ensure that wherever possible data entry is within an allowable or acceptable range.

1.6. That candidate details are unique and that each competitor has one and only one identity on the system. Similar checks on 'Member' and 'Trade'. (Identities must be unique to ensure that no duplicate records exist.)

2. Security

2.1. Ideally the program should run on two separate computer systems. Each one having a complete set of up to date results. This enables the second system to be used in the event of a system failure. (The BIC and ICS systems were run entirely independently.)

2.2. Two backup copies should be made every night at the end of the data entry session. One of these should be removed from the site and held, in a remote location to ensure that recovery is possible in the event of fire or other structural failure on the competition site. (Backup copies were produced – not known if one set was removed from the site.)

2.3. Only named staff should have access to the software. Use of the software for the entry of mark data or for the production of final results should be strictly limited and protected from access by non authorised personnel. (Access to the area where mark processing was occurring was unsatisfactorily controlled. There needs to be an enforced control to ensure that documents being processed are correctly checked and signed.)

2.4. Completed or partially completed Form 5 or Form 6 results should not be kept in workshop locations unless agreed by all experts that this is satisfactory. If they are kept in workshop locations appropriate security measures should be agreed. (Perhaps by two experts witnessing locking and opening at commencement and opening of each session.). Ideally the forms will be taken (by two jury panel members) to the IVTO security office at the end of each day.

3. Verification and Validation Procedures

3.1. Trades using a modular marking system should decide, before the competition commences, exactly what will be marked each day. They should also confirm the maximum marks to be allocated to each criterion for each day. These marks should be entered in a new Form 6 and totalled by row and column to confirm that they are correct and result in a total mark of 100. (This was not the procedure used because it was the first time modular techniques were attempted and it would have been difficult to enforce the requirement at this competition.)

3.2. Modular marks should be entered into the system prior to the commencement of the competition. This data entry should include all total values. both criteria and daily or modular totals (e.g. row and column totals.)

3.3. When completing Form 6 for modular results the jury should also calculate the total marks achieved be each competitor for that module or day. The computer software should require the entry of both marks and totals. The marks entered should then be checked within the system to ensure that no mark or total exceeds the agreed maximum and the entered total should be validated against the calculated total for each and every module. day or criterion. This will ensure that no mark exceeds the maximum and that total marks have been correctly calculated. Errors should result in immediate rejection of data entry and Form 6 should be given back to the chief expert to check. (This was not undertaken during this competition. Only visual checks were made of totals and this proved unsatisfactory as many visual checks proved to be incorrect.)

3.4. When the marks for a module or completed competition have been entered a result sheet should be printed out to enable the chief expert to check the data entered. The chief expert should carefully check and initial each result and every printed page to confirm that the computer results are correct. (This procedure was implemented but in many cases chief experts took little care in the check and in some cases did not check the results at all because they were not asked to do so. The problems were due to open access to the checking and data entry area and that some personnel did not take care to implement the procedure correctly.)

3.5. The layout of Form 6 should be altered to accommodate the modular format. One of two methods may be used, either

- Form 6 includes a day number and new printed copies, containing the marks accumulated, are given to the expert for entry of the next days results. In most modular trades this will result in the production of four copies of Form 6 for each competitor. The advantage of this procedure is that all experts will see the computer entered results. The disadvantage is the large quantity of copies of Form 6 that are required.

- Alternatively a redesigned Form 6 could be used. This will contain four days printed on the reverse side so that there are appropriate spaces for each day of expert signatures. Experts would then sign to confirm the marks at the end of each day.

3.6. The procedures used by jury panels to calculate results on Form 5 are often very complex. It is unlikely that all experts (or even Jury Presidents) will understand the many complex calculations used. It is suggested that an independent check of at least one set of these calculations is undertaken. When handing in Form 6, chief experts could be asked to bring an example Form 5, together with any calculations, for confirmation of correct calculations. (This procedure was not used and some chief experts and jury presidents had difficulty in calculating the results to be transferred from Form 5 to Form 6.)

3.7. Jury presidents, chief experts and experts are required to check and confirm with appropriate signatures that the marks have been correctly transferred from Form 5 to Form 6 and that no mark exceeds the maximum allowed for any one component. (The signatures of experts and jury presidents were missing on some Form 6 documents. The outcome of these problems is not known.)

3.8. Where any marks have been altered on Form 6 they should be confirmed to be the correct mark. Two requirements could be implemented. These are:

- the initials of the chief expert where only a total mark is unaffected
- The initials of at least two other experts where alteration of marks has also resulted in a change to the total mark. (Great care should be taken to check that material such as tippex has not been used. This type of correction is difficult to detect at peak times of mark entry. It is suggested that such material is banned from use and that any alteration be made in such a way that the original figures remain readable.)

3.9. Appropriate procedures should be applied to minimise data entry errors.

- only approved persons entering data (Adhered to in this competition.)
- data with more than two decimal places should be automatically rejected. (Not originally provided for in the two software programs but the ICS program was corrected to reject any three decimal place entries.) It is suggested that to avoid errors of miss entry the system actually allows entry of more than two decimal places but that such entry results in a rejection of that set of marks so that Form 6 has to be returned to the chief expert for correction.
- Only the chief expert (and authorised data entry staff) should be present during data entry. (This was not applied during the entry of results and resulted in forms being mislaid, being placed in folders without confirmatory signatures or missing scrutiny for altered results.)

4. Software facilities and ease of use

4.1. To support IVTO administration the software must provide the following facilities (Generally in three languages.):

- Entry of member names and member code
- Entry of trade names and trade numbers
- Entry of trade descriptions
- Entry of competitor details
- Entry of competitor teams for one trade competition
- Entry of marking criteria
- Entry of marks for each criteria
- Entry of total marks for each criteria
- Entry of total marks for each module or day
- Entry of total marks for the completed competition
- A range of output reports to suit administration requirements

4.2. Problems experienced with the BIC software:

- Does not support modular marking techniques
- Does not support storage of technical descriptions
- System does not validate total with data entry
- The word 'Competition' is confusing in the IVTO environment and is used to define a 'Trade'
- Similarly the word 'Description' is also confused with 'Trade'
- Capital letters when entered correctly often show up as lower case letters when displayed.
- When searching the records it is possible to accidentally enter data such as member code and thus corrupt existing data
- It is possible to enter more than two decimal places. This could cause errors in the results. (The result of entering such data is that some form of character wrap occurs and the number appears on two lines.)
- It is possible to enter marks that e..ceed the maximum criterion mark.
- It is possible to enter marks that cause the total to exceed 100.
- Entry of the decimal point requires entry of a comma
- Marks entered using a full stop are multiplied by a factor of 10.
- When the figure 1.254 is entered 8 times BIC gives a result of 10.03. The correct result of this data entry according to the rules is 10 because all results are rounded to two decimal places.
- Similarly the entry of 1.255 8 times results in a total mark of 10.04 when IVTO rules would give a result of 10.08
- Does not allow the entry of competitor teams. E.G. those trade competitions where more than one competitor may be involved.
- Help information is provided within the system but this is very limited and should be improved. A more detailed printed manual should also be produced. This should include technical documentation that fully describes the program with appropriate comment to enable maintenance as necessary. Such documentation must also include definitions of all calculations used.

4.3. Problems experienced with the CIS software:

- System does not validate modular data entry by validating against the agreed maximum mark.
- System does not validate the entry of the total mark.
- It is possible to enter more than two decimal places. Entry of results such as 1.165 in several criteria and for different days resulted in a total of 18.64 when the IVTO rules would have resulted in 18.72. (This error was corrected before the ICS system was used for mark entry.)
- Similarly the entry of 1.174 resulted in a total of 18.78 when the IVTO rules would have given a total of 18.72. (This was also corrected before the program was used for the entry of competition marks.)
- System does not validate totals during data entry
- It is possible to enter marks that exceed the maximum criterion mark.
- It is possible to enter marks that cause the total to exceed 100.
- The bar code reader used to ensure that competitor results were entered correctly was unreliable. It is suggested that a laser reader is used in future.
- Help information is provided within the system but this is very limited in description and should be improved. A more detailed printed manual should also be produced. This should include technical documentation that fully describes the program with appropriate comment to enable maintenance as necessary. Such documentation must also include definitions of all calculations used.

5. Result Issue

5.1. The results from each of the two software packages were compared with the following conclusions:

- ICS and BIC results differed. (There were occasions when the BIC system concluded that different medals should be issued even when the difference between the mark of the first specific grade of medal differed by only two points to that of the next stated grade of medal.)
- The ICS and BIC systems differed in the calculation of 'Mean' values. (Hand calculation showed the ICS system to be correct.)
- The ICS and BIC systems differed in the listed number of competitors from each country. (This was because the BIC system did not seem to allow for the entry of a team of two persons.)

- The ICS and BIC systems differed in their results for trades 5, 25, 31, 43, and 45. (The results for 5, 25 and 31 were due to incorrect interpretation of the 2 point difference rule by the BIC software. The difference in results for the demonstration trades was due to incorrect interpretation by BIC of the minimum number of competitors rule where 5 or less competitors limits the medals to gold only.
- The ICS was found to be without error according to hand calculation of results. (The auditor would wish to re-iterate his lack of knowledge of the calculations involved. The calculations used were those considered to be correct for such analysis. Microsoft Excel functions were used to confirm calculations. Copy of calculations used is attached.)

6. Proposals for the future

6.1. The range of marking documents in use should be minimised. IVTO should consider the possibility of data entry within each trade workshop. This would require the use of a LAN with a workstations in each workshop. A wireless LAN might be considered suitable in the future. This procedure would require a carefully constructed audit trail. Control of data entry would also need to be established so that data entry can only take place at certain times and after a given time it becomes read only information. In this way each jury panel would become entirely responsible for the accuracy of their results and associated data entry. Appropriate controls could still be established to ensure satisfactory procedures are used and that all experts confirm results.

6.2. Jury presidents and chief experts should receive a one day training session before the commencement of each competition. This should include techniques for marking and calculating results for both forms 5 and 5a and the completion of Form 6. Persons failing to understand this procedure should not be accepted as senior jury members.

6.3. A training pack covering a range of examples for the marking system should be produced. This should be provided for each country with a recommendation that each country train their experts in operation of the system.

6.4. Copies of the selected IVTO software, with some sample results, should be available for each member to purchase for the purpose of training.

7. Conclusions

7.1. The auditor would wish to thank all involved for co-operating with someone selected to do this task at such short notice. Particularly in view of the number of questions asked and guidance required to enable the task to be undertaken with any degree of competence.

7.2. I learned a great deal and had an enjoyable time working with all involved.