INDUSTRIAL PROFICIENCY TEST (IPT)

TECHNICAL MANUAL

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Introduction

Selecting the appropriate candidates to perform the job effectively has been one of the biggest challenges faced by many organisations. From the organisational perspective, the purpose of selection is to select the most suitable candidate to fill the needs of the job at hand. Such a decision can have a direct influence on a company's performance, productivity, and ultimately its profitability.

Attaining the best possible match between position and applicant is also important from the job applicant's perspective. Job seekers are becoming more assertive in selecting the organisations they want to work for. Information that specifies the job requirements is important to job seekers, as it assists them in deciding whether or not they want to join an organisation.

The use of assessment and selection methods has received much research attention. Poor selection decisions can be costly and disruptive for an organisation as well as the applicant. Thus, there is a need to employ the appropriate selection tool(s) to increase the chance of successful selection.

The Cognitive Ability Test (a psychometric test) is designed to assess the ability or aptitude of the person in relation to their capability to complete or learn to perform a particular task. Some cognitive ability tests measure specific abilities such as reading comprehension, vocabulary, math proficiency, or mechanical reasoning. The requirements of the particular job dictate which tests are selected. These tests can be combined into batteries that will assess the specific requirements of a particular job. The Cognitive Ability Test is a popular tool for personnel selection. A considerable number of studies suggest that cognitive ability tests are very good predictors of job performance, the acquisition of job knowledge on the job, and performance in job training programmes (Schmidt & Hunter, 1998; Guinn, 1991). In fact, such research has consistently found cognitive ability tests such as the IPT to be the *single best predictors* of job performance (Grubb, Whetzel, & McDaniel, 2004) and an employee's ability to profit from and perform in job training programmes (Hunter, 1986; Hunter & Hunter, 1984; Ones et al., 2005a; Ree & Earles, 1992). Researchers have found that selection assessments that are good predictors of future job performance and improve the chances of selecting the most suitable candidate for a job. This leads to substantial improvements in employee performance, increased monetary value, and increased learning of job related skills (Hunter, Schmidt & Judiesch, 1990).

It is obvious that the core skills sought when selecting and assessing staff vary from industry to industry and sector to sector. Designed for use with the manufacturing and processing sectors, the Industrial Proficiency Test (IPT) provides an indication of the extent an individual is able to perform industrial work tasks effectively. Specific items have been developed to measure required knowledge, abilities, and skills that are appropriate to jobs in the manufacturing and processing sectors.

The Need for the Industrial Proficiency Test

There are a number of organisational advantages and benefits to employing the IPT in a selection process.

Standardised measures

- The same test can be given to all the applicants, with a standardised method used for scoring and interpreting the results.

- The individual's score can be compared to a reference group, usually known as a norm group. Norm groups are composed of people who have similar characteristics (e.g., age, education, gender, or job classification). Norms become a standard against which appropriate comparisons of test scores can be made.

Job-related measure

- A highly face valid test is a good predictor of future performance and job-related learning.

Reliable, valid, and suitable selection tools

- The Industrial Proficiency Test can be administered to a large group of individuals for a wide range of jobs within the manufacturing and processing sectors. The IPT can be administered to applicants for either entry level or advanced positions.

- The IPT is less time consuming than interviews or assessment centres (Schmidt & Hunter, 1998).

- The IPT can provide information which cannot be obtained using other methods. For example, while much information can be gained from the commonly used selection methods (e.g., job interviews, assessment centre, work sample, CV and applicant form), such methods suffer from a variety of weaknesses.

- Job interviews are useful for obtaining information about a person's values, experiences, and attitudes. Yet they provide little opportunity for assessing a job applicant's ability to perform the job.

- Assessment centre and work sample tests have both proven effective methods of personnel selection. However, the costs involved in employing these methods are usually expensive. These methods are also very time consuming.

- Other commonly used selection methods, such as resume checking, may not be applicable to this context. Job applicants for this sector predominantly consist of unskilled workers. This group of people demonstrate little understanding or usage

- of either verbal skills or language writing abilities. Thus, applicants may not be able to submit the standard resume that is typical of those who apply for more advanced positions.

- The use of the IPT should overcome the above-mentioned limitations. The IPT is able to provide an assessment of an applicant's likely future job performance. This assessment is obtained under exam conditions. This increases the likelihood that such an assessment will provide an objective, true reflection of an applicant's ability.

Candidate demographics

- The IPT is suitable for the selection of unskilled workers. This group of people may have little understanding of either verbal skills or writing abilities. Many of the established ability tests are designed for graduate, management calibre adults, or clerical administrative staff. The ability to generalize such tests to the manufacturing context is questionable.

- The IPT can help fulfil organisational recruitment needs. The IPT was specifically designed as a personnel selection and developmental tool for manufacturing and processing sector organisations. This makes the IPT the ideal assessment tool for matching applicants and incumbents to work roles within this sector.

Bottom line benefits of using the IPT

Research has shown that good workers do twice as much work as poor workers, and that the difference in value between a good and a poor worker is roughly equal to the salary they're paid (Cook, 2004). Moreover, as an unintended consequence of legislation designed to protect employee rights, such as 2004's amendment to New Zealand's Employment Relations Act, the dismissal of substandard employees, once hired, can be legally problematic (New Zealand Press Association, 2005). Organisations able to effectively and consistently select productive over less productive employees will thus more probably achieve their strategic goals. Using the Industrial Proficiency Test to screen job applicants leads to an increase in the quality of the selection decisions associated with achieving exactly such strategic goals.

Ensuring that selection procedures actually result in the selection of productive employees is essential in today's highly competitive economic market. The price of selecting, hiring, and terminating employees is high. So is the price of losing superior workers to one's competition (Cook, 2004). The industrial workforce is comprised of employees of widely discrepant degrees of proficiency. Yet employers must attempt to choose those who will be most proficient among potential employees. Mistakes in this selection process can result in greater absenteeism and turnover, reduced productivity, decreased morale, and even monetary loss as a consequence of lacklustre performance, theft, or fraud (Cascio, 1991). As we saw in the preceding section, one of the most effective and efficient ways of making such selection decisions is by using the IPT.

As a result of the IPT's ability to predict future job performance and trainability in industrial settings the possible economic gains an organisation can accrue by using the IPT in selection decisions is enormous (Grubb, Whetzel, & McDaniel, 2004). Methods for measuring employee performance either as a dollar value of output or as a percentage of the average output in a given job have been summarised by Schmidt and Hunter (1998). Forty percent is a conservatively estimated difference between the dollar value outputs across individuals (Schmidt & Hunter, 1983; Schmidt, Hunter, McKenzie, & Muldrow, 1979; Schmidt, Mack, & Hunter, 1984). The economic importance of this estimate for New Zealand organisations can be illustrated with an example based upon the average salary of approximately $38,000. According to the above estimate, the standard difference in productivity among employees for a job with an annual salary of $38,000 would be worth $15,200. If the performance of employees is normally distributed, employees at the 84th percentile (one standard deviation or unit of measurement greater than the average employee at the 50th percentile) will product $15,200 more per year than the average employee. The difference between 84th percentile high-performing employees and 16th percentile poor-performing employees (two standard deviations or units of measurement below the 84th percentile employee) would be $30,400. These differences clearly represent considerable variance in both productivity and dollar value to organisations, and in doing so the success or failure of such organisations. In this respect the IPT can make all the difference between hiring an employee who will financially benefit an organisation, and hiring one who will financially harm or hinder an organisation.

Examples of the positive role the IPT can play in helping companies' hire the best possible staff abounds. One of the largest international investors in food technology, research, and development has become an IPT convert. For a company that employs thousands of staff and has an export business alone of around $70 million per year hiring the right people is crucial. To achieve this goal and maintain its high standard of quality product it uses the IPT, and has being doing so with great result.

Other examples of major companies that have decided after researching the cognitive ability test market to use the IPT as their employee selection test of choice include companies within the recruitment, packaging, and manufacturing industries. One phenomenally successful business leader within the food industry has become a committed IPT user. This is a company that employs approximately 1,500 people across 3 sites with approximately 1,200 product lines. It is also a company with a commitment to keep delivering reliable, high quality, and exciting food solutions. This makes crucial the quality of staff selection decisions. The success of the IPT's use in this regard is perhaps most readily inferred from the increase in this company's profitability that coincides with its use of the IPT.

The temporary staffing industry provides a further example of the financial benefits that so often coincide with the improved quality of staff selection resulting from IPT use. One major user of the IPT is a Fortune 500 company that operates in 30 countries, provides employment to more than 700,000 employees annually, and has been involved in the temporary staffing industry since the 1940s. The success of this company in such a highly competitive arena has depended upon its willingness to lead the way in investing in people. This focus has allowed this company to continue to meet the evolving challenges of workforce flexibility with staffing solutions tailored to the precise business needs of its customers, both locally and worldwide. In this respect the IPT has served the crucial function of ensuring those assigned work within an industrial context are those most capable of successfully undertaking such work. The relationship between this testing and the importance of sourced employee proficiency to this company's profitability can be seen in the continuing growth in its earnings, which were up from $4 billion dollars in 2001, to $5.3 billion dollars in 2005 - a growth rate of approximately 30% in total turnover.

In summary, by using the IPT employers can more accurately assess the likely proficiency of prospective employees. As show above, there is a huge difference in the dollar value of output or percentage of the average output in a given job between employees of differing proficiency. The IPT allows employers to make the best possible selection decisions in this respect. In doing so the IPT helps companies achieve their strategic goals by decreasing costs while increasing revenue. Moreover, the IPT has an established history of successful use in the workplace by highly profitable and discriminating organisations.

Development of the IPT

The IPT was designed as a multi-choice exercise to aid in personnel selection and development. Multi-choice tests are quick. They are simple to administer and produce results which are readily calculated and evaluated. Moreover, the IPT is potentially more valid and reliable than other methods of assessing a job applicant's aptitude or ability to perform the job effectively. Through qualitative and quantitative means, OPRA Ltd, has aimed to produce a psychometric tool with high levels of face, content, and predictive validity (see page 14).

Defining the required knowledge, skills, and abilities to do the job.

To identify the core knowledge, skills, and abilities that are important to the job, an initial review of information supplied by clients, regarding the tasks involved, was conducted. This information included production procedures and training manual. Information was also gathered in consultation with work supervisors. This facilitated a better understanding of job requirements and worker routines.

With the work sample materials supplied by the clients and through consultation, the key abilities required by process workers for effective performance were mapped-out. The abilities identified as necessary for good job performance included: the ability to follow written instructions, the ability to perform a basic level of numerical tasks, the ability to attend to details with high accuracy, and the ability to understand new ideas in a novel learning situation. In order to identify items with high discriminate validity, four subtests of IPT were developed. They were: Following Instructions, Numerical Test, Checking Test, and Symbolic Reasoning. A list of 30 multi-choice questions was developed to measure each of the specific abilities contained within these subtests (120 items in total).

The Symbolic Reasoning test construct is a widely proven test format. It is used to assess higher reasoning abilities, general problem solving, and the ability to understand new ideas in situations of new learning. It is the least contaminated by education level or language proficiency and the most culture fair.

Prototype.

The first trial of the Industrial Proficiency Test (the beta version) included 30 items for each subtest. This prototype was trialled over the period of one month on participants from different organisations within the manufacturing and processing sectors. From the 150 odd Beta test sample, item analysis permitted the shorter form and shorter timed "gamma" IPT test to be constructed. It is a subset of the original items and has the same characteristics as the original.

The final version of the IPT.

The test currently has two administrative methods: pencil-paper version and computer-based assessment. Online administration is due to follow.

Limitations of the IPT.

The IPT is an indicator of abilities only, but as such serves its purpose well. The early release norms are relatively small, but appear to be stable as the sample sizes increase.

The Uses of the IPT

Selection

- The IPT is a cognitive ability test that can aid employment decisions where the required knowledge, skills, and abilities for effective job performance can be measured.

Promotion

- If used alongside other objective, reliable forms of assessment, the IPT can be used to assist in promotional decisions.

Realistic Job Preview

- The IPT is useful as a recruitment device to show prospective employees realistic aspects of the job and organisation. If the ability to follow instructions, to perform a basic level of numerical and symbolic reasoning, and to attend to details with high accuracy are necessary for good job performance, then the use of IPT during the recruitment and induction process can help instil the importance of the job requirements to the new recruits.

Training needs analysis

- The IPT can also help in decisions concerning whether an employee requires training and, the extent to which training is required.

Training outcome assessment

- If an organisation is spending a large amount of money on an employee training programme, it is imperative that the effectiveness of the training is evaluated. One way to measure training effectiveness would be to assess knowledge gains made before and after the administration of the IPT.

Test Statistics and Table of Norms

At the time of analysis, the IPT had one normative group of Process Workers. This norm group consisted of 134 employees. This norm group were recruited from eight different organisations within the Australasian region. The demographic details of the norm group are displayed in Table 1 below.

Table 1: IPT Norm Group Demographics

		Mean Age	Range	SD Age	N
Gender	Female	38.29	16-59	10.31	78
	Male	35.07	17-57	10.70	43
Education	Less than Secondary School	40.57	17-59	12.03	24
	Secondary School	37.74	21-56	9.46	42
	Industry, Trade Training	30			1
	Cert., Dip.	27	18-34	7.07	4
	Tech., Institute/TAFE	30	18-44	9.67	5
	University Degree	34.6	23-45	7.83	6
Ethnicity	Australian	38.17	20-59	9.87	40
	NZ European	35.45	18-53	13.13	11
	Maori	30.47	16-49	11.69	15
	Asian	37.96	23-54	7.88	26
	European	41.33	19-56	10.90	12
	Indian	33.5	25-42	12.02	2
	Pacific Islander	21.33	18-28	5.77	3

The norm groups mean scores for each section of the IPT.

The distribution of the norm group respondents' mean scores on each section of the IPT are illustrated in Figures 1-4. They show good psychometric properties.

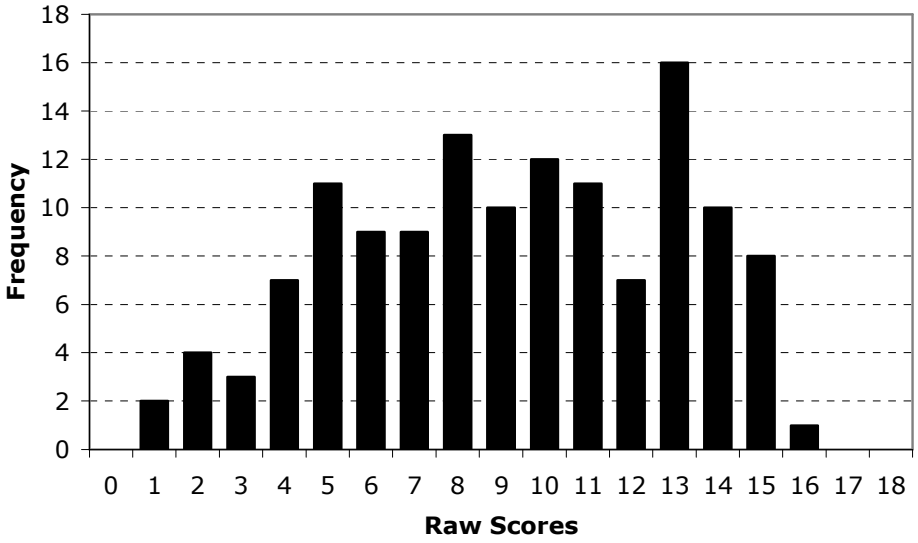

Fig 1. Distribution of the IPT norm group respondents' mean scores on the Following Instructions Test.

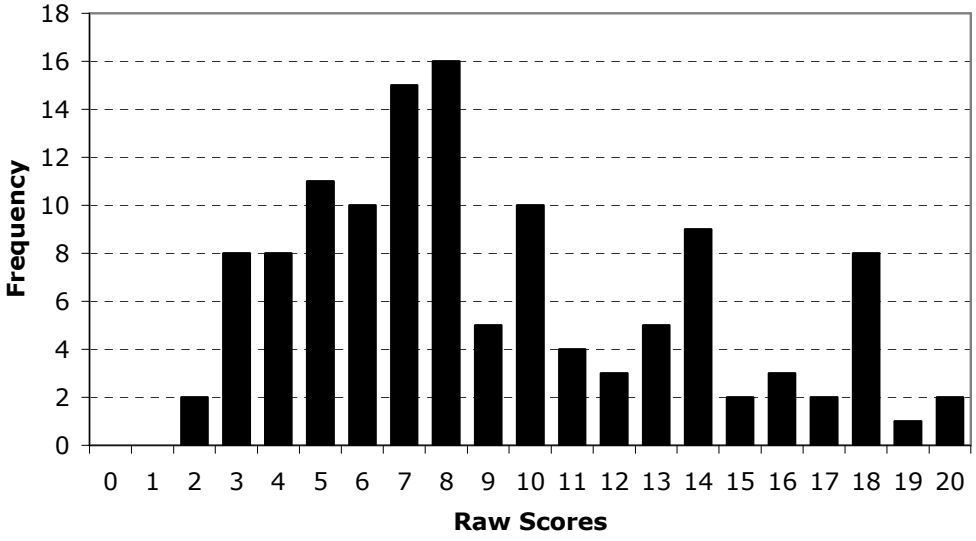

Fig 2. Distribution of the IPT norm group respondents' mean scores on the Numerical Test.

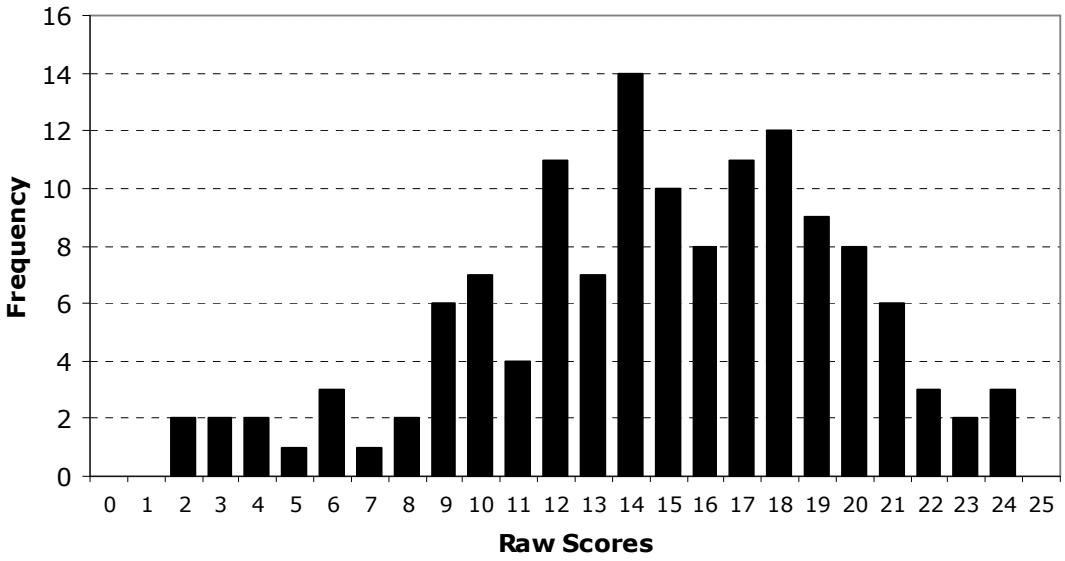

Fig 3. Distribution of the IPT norm group respondents' mean scores on the Checking Test.

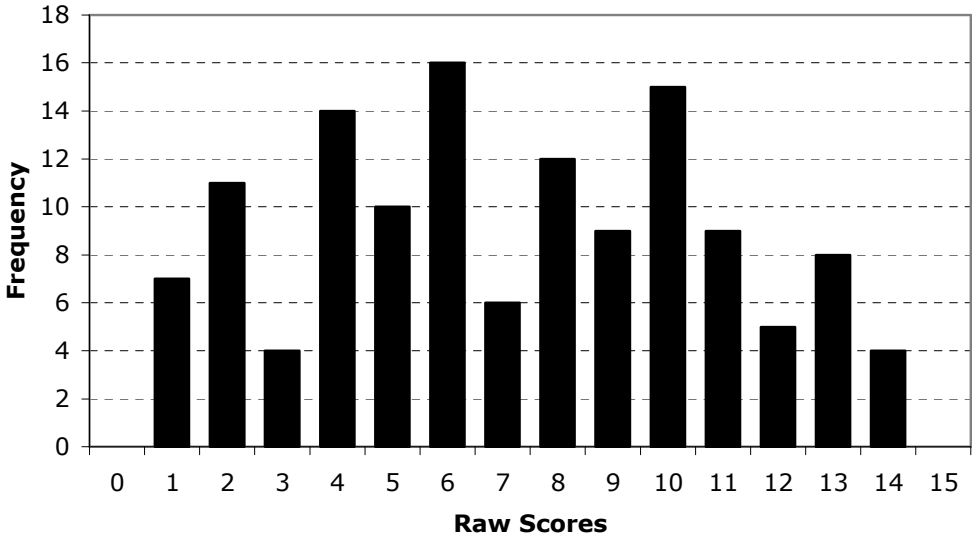

Fig 4. Distribution of the IPT norm group respondents' mean scores on the Symbolic Reasoning Test.

Gender Differences in the IPT.

The mean scores on each section of the IPT were compared across males and females to determine if there was any significant gender difference. Table 2 summarises these results.

Table 2: Mann Whitney Test for Gender differences on IPT.

IPT	Mean Females	Mean Males	z-value	P	Females N	Males N
Following Instructions	9.16	9.5	-0.39	0.698	80	44
Numerical	7.90	11.05	-3.01	0.003**	73	41
Checking	14.63	15.16	-0.52	0.606	80	44
Symbolic Reasoning	6.80	8.09	-1.82	0.069	76	44

** p<.01

Table two shows no significant difference between males' and females' scores on the Following Instructions, Checking, or Symbolic Reasoning test components. However, consistent with findings in the current literature, there was a significant difference on the Numerical Test, with males tending to score slightly higher on average than females.

Age Differences in the IPT.

The influence of age on IPT scores was examined using a sample of 121 respondents for whom age data was available. The mean scores on each section of the IPT were compared across age. Table 3 summarises these results.

Table 3: Spearman correlations of the relationship between age and scores on each section of the IPT.

IPT	Age (*r*)	p
Following Instructions	-0.27	0.003**
Numerical	-0.21	0.026*
Checking	-0.17	0.068
Symbolic Reasoning	-0.31	0.01**

* p<.05
** p<.01

All four parts of the IPT were found to be negatively correlated with age. However, only Following Instructions and Symbolic Reasoning showed a statistical significant relationship at the alpha level of 0.01. This is normal for speeded tests of this nature.

Educational Differences in the IPT.

The influence of education on IPT scores was examined using a sample of 82 respondents for whom educational qualification data was available. The mean scores on each section of the IPT were compared across educational groups. Table 4 summarises these results.

Table 4: Mann-Whitney U test, mean score and chi square values in relation to education level for the IPT norm group respondents.

IPT	Less than Sec. School	Sec. School	Industry, Trade Training	Cert., Dip.	Tech, TAFE	Uni. Degree	Chi square value	df	p
Following Instructions	9.65	10.74	11	11	11.2	8.44	4.95	5	0.42
Numerical	9.96	10.41	11	8	10.4	7.83	2.44	5	0.79
Checking	15	16.10	16	18	15.4	17.17	1.60	5	0.90
Symbolic Reasoning	6.83	8.56	12	8.75	10	7.5	6.89	5	0.23

As illustrated in Table 4, there was no significant differences detected between the IPT norm group respondents mean scores on each subtest and their level of educational attainment.

Ethnic Differences in the IPT.

The influence of ethnicity on IPT scores was examined using a sample of 82 respondents for whom ethnicity data was available. The mean scores on each section of the IPT were compared across ethnic groups.

Some differences were found, however they may have been due to sampling bias. Also, the incidence of English as a second language was unknown. Further studies on larger samples that take language comprehension into account are required.

Reliability and Validity

Reliability and validity are important issues in professional psychometric testing.

Measures of Reliability

Reliability refers to the consistency of a test. If a test or questionnaire is reliable, then we would assume that the same person sitting the exercise on two different occasions would get a similar score on both occasions.

Internal Consistency Reliability

- This is a measure of the extent to which the different parts of a test are measuring the same thing.
- A study conducted on 124-134 participants revealed that the coefficient alpha (internal consistency) on each section of the test was above r=.07 (an acceptable level of internal consistency). These results are illustrated in Table 6.

Table 6. Coefficient Alpha for IPT

	r	N
Following Instructions	0.76	134
Numerical	0.81	124
Checking	0.87	134
Symbolic Reasoning	0.73	130

Measures of Validity

Validity is used to determine if the test content actually measures what it is supposed to measure.

Face Validity

- A measure is said to have face validity if users of the instrument think the content of the selection tool closely corresponds to what the questionnaire claims to measure. As the IPT was designed and assessed in conjunction with clients from the manufacturing and processing sectors, the IPT tool can rightly claim to have a high degree of face validity.

Content Validity

- Content validity refers to the extent to which a test adequately covers the subject matter being tested (Coolican, 1994). The content validity of the IPT was measured in relation to its intended use as a measure of a job applicant's aptitudes and abilities in personnel selection and employee development.

- The content of the IPT was developed on the basis of both information supplied by clients and consultation with work supervisors. On this basis the IPT comprises four criteria for effective job performance (the ability to follow instruction, the ability to perform basic numerical tasks, the ability to perform basic symbolic reasoning, and the ability to attend to details with high accuracy). Furthermore, the initial 120 questions for the IPT were trialled with a representative sample. The results of this trial were then evaluated via robust statistical procedures. Only items that were found to reach a significant statistical level were included in subsequent IPT development. These are all good reasons for having confidence that the IPT possesses a high level of content validity.

Administration Guidelines

For high quality results, the IPT must be administrated using the correct procedures. Ideally, this tool should always be administrated face-to-face and by a trained practitioner. Privacy and freedom from interruption is also critical to ensure the accuracy of results. Some points to keep in mind when administering the IPT are:

- The IPT is designed to measures one's ability to perform the job effectively. It does so via four subtests: Following Instructions, Numerical Test, Checking Test, and a Symbolic Reasoning Test.

- These results will aid the decision making process. However, such results are not intended to stand-alone. They are instead intended to be used in conjunction with other job relevant information.

- The IPT is a timed test.

- Each question on the IPT has 5 possible answers (1, 2, 3, 4 or 5). One and only one answer is correct in each case.

Delivering Feedback on the IPT

For many participants the feedback session can be quite threatening, particularly when they have not been exposed to this kind of analysis before.

As the person delivering the feedback, it is important to put the participant at ease and alleviate any stress they may have attached to the assessment process. Feedback is not so much a process of "telling" the participant information about themselves, but of shared exploration.

Key Skills Which Can Facilitate Feedback

1. Attending skills.

Good attention is a necessary component for good communication and demonstrates to the other person that you respect them and are interested in what they have to say. You can demonstrate your attention by:

- Sitting with your body facing the other person.
- Being responsive facially (i.e., spontaneous smiling or nodding).
- Occasional leaning towards the person to indicate empathy.
- Maintaining good eye contact by way of spontaneous glances to express interest.
- The repetition of one or two key words to indicate understanding.

2. Encourage questions and the expression of feeling.

Questions are a useful tool to help the feedback session move along and can provide valuable insight into the participant's experience of undertaking the exercise. Questions provide room for the individual to express him/herself without having to fit into any category pre-determined by the assessor. It also allows them to bring additional data into the interpretation of results.

Good questions are:

- Single-focused
- Open-ended
- Short and succinct
- Start with "what", "how", "could" (they allow greater movement around a topic)

Poor questions are:

- Closed
- Overly verbose
- Ask multiple questions
- Start with "why" (these questions put people on the spot)

3. Remain objective and open.

When feeding back assessment results, try to avoid making value judgements and interpreting the results in light of what else you know about the participant (i.e., avoid making judgements on the basis of comments made by past colleagues or personal friends of the participant).

Deliver feedback at a time that you have the profile to refer to. This will help you remain factual in any discussion of the results. Although potentially difficult, you have an ethical obligation to inform the participant of the overall picture and pattern which emerges. Information on one's "areas for development" may be part of the brief. If you anticipate a negative reaction to any information, try to work out in advance how best to respond.

Be specific in the interpretations given and try to avoid references to general statements of "high" or "low" scores which have little practical value.

A Final Note…

While the IPT is revealing and informative, it is only a starting point. Take time to understand the candidate by asking questions and making your own observations.

Each individual likes to succeed. Be aware of the particular developmental needs of each candidate and help foster the person's awareness and growth in these areas.

Specific Instructions

Distribute the test booklets and answer sheet for the IPT and allow the candidate(s) time to fill in all the details.

SAY:

"In front of you, is the Industrial Proficiency Test answer sheet. Please fill in all the details required at the left hand side of the page. When you are ready, turn to the Industrial Proficiency Test booklet and read the instructions on the inside front page."

At this point, the test administrator should reiterate the following points:

- Circle only one answer to indicate your choice on the answer sheet provided. In the case you wish to change any answer given, completely erase your first choice, and fill in your new answer.

If there are no further questions, allow the candidate(s) to turn the page and begin the actual exercise. Once completed, collect the test booklets of each candidate and their named answer sheets. It is essential when administering the IPT that standardised instructions are used.

Sample IPT Report

INDUSTRIAL PROFICIENCY TEST (IPT) PROFILE CHART

Raw	Attempted	Test	Low / Medium / High (1 2 3 4 5 6 7 8 9)	%ile
4	9 of 18	Following Instructions		7
3	5 of 20	Numerical Test		2
10	12 of 25	Checking Test		14
1	9 of 15	Symbolic Reasoning		0

Scores based on stanine values with Mean=5 and SD=2.
%ile=percentile i.e. percentage of sample below respondent's score.

Norms for each of the IPT tests are based on the groups below.
Following Instructions: 134 Process Workers
Numerical Test: 124 Process Workers
Checking Test: 134 Process Workers
Symbolic Reasoning: 130 Process Workers

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