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## RESEARCH METHODS

# Rank ordering and paired comparisons – the way Cambridge Assessment is using them in operational and experimental work

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In this article we describe the method of paired comparisons and its close relative, rank-ordering. Despite early origins, these scaling methods have been introduced into the world of assessment relatively recently, and have the potential to lead to exciting innovations in several aspects of the assessment process. Cambridge Assessment has been at the forefront of these developments and here we summarise the current 'state of play'.

In paired comparison or rank-ordering exercises, experts are asked to place two or more objects into rank order according to some attribute. The 'objects' can be examination scripts, portfolios, individual essays, recordings of oral examinations or musical performances, videos etc; or even examination questions. The attribute is usually 'perceived overall quality', but in the case of examination questions it is 'perceived difficulty'. Analysis of all the judgements creates a scale with each object represented by a number – its 'measure'. The greater the distance between two objects on the scale, the greater the probability that the one with the higher measure would be ranked above the one with the lower measure.

## Background

The method of paired comparisons has a long history, originating in the field of psychophysics. Within psychology it is most closely associated with the name of Louis Thurstone, an American psychologist working in the 1920s – 1950s, who showed how the method could be used to scale non-physical, 'subjective' attributes such as 'perceived seriousness of crime', or 'perceived quality of handwriting'.

The method was introduced into examinations research in England in the 1990s principally by Alastair Pollitt, at that time Director of Research at Cambridge Assessment (then known as UCLES – the University of Cambridge Local Examinations Syndicate). He showed how the method could be used for scaling video-recorded performances on speaking tasks

in the field of language testing (Pollitt and Murray, 1993), and then went on to apply it to the perennially problematic task of comparing work produced in examinations (in the same subject) from different examination boards, or from different points in time. A detailed description and evaluation of the method's use in 'inter-board comparability studies' can be found in Bramley (2007). Rank ordering is now used extensively in the comparability research work of Cambridge Assessment, and its use in operational aspects of examinations – awarding etc – is being explored and validated. But as with all approaches, it has not and will not be adopted in specific settings without testing its suitability – principally its validity and utility. This requirement for validation is in line with the standards and criteria laid down in The Cambridge Approach.

Although the mathematical details of the method can appear quite complex to non-specialists, at heart the method is very simple, the key idea being that the more times one object 'beats' another in a paired comparison, the further apart they must be on the scale. The resulting scale values are taken to be 'measures' of whatever the comparison was based on, for example 'quality of work produced'. It is assumed that, when comparing work produced in different examinations, the experts making the judgements can allow for any differences in the overall difficulty of the questions or tasks that the examinees were required to respond to.

The main theoretical attraction of the method from the point of view of comparability of examination standards is that the individual judges' personal standards 'cancel out' in the paired comparison method (Andrich, 1978). For example, a judge with a 'severe' personal standard might think that two pieces of work were both worthy of a grade B, while a judge with a more lenient personal standard might think they were both worthy of a grade A – but the two might still agree on which of the pair was better, that is, on the relative ordering of the two pieces of work.

## Using the approach in research and assessment

In practice, the paired comparison method typically is very demanding – it can be extremely resource- and time-intensive. The issue for its deployment depends not least on reaching a judgement regarding its benefit-effort ratio in a specific context. In an effort to increase the efficiency of the process, Bramley (2005) showed how the same principles could be used to create a scale if the experts were asked to put several objects into a rank order rather than comparing just two. Using rankings of several objects allows many more comparisons to take place in the same time, with the advantage of allowing whole mark scales to be linked, rather than just grade boundary points. This idea of using expert judgement to link the mark scales on two (or more) tests has been the subject of a great deal of research at Cambridge Assessment, leading to several conference papers and publications (see bibliography). Black and Bramley (2008) have argued that it is a better (more valid) use of expert judgement than the method that is currently used as part of the regulator-mandated grade boundary setting process in GCSEs and A levels, and that it could have a role to play in providing one source of evidence for decisions on where to set the grade boundaries. A detailed evaluation of the rank-ordering method as a method for maintaining standards, or for investigating comparability of standards, can be found in Bramley and Gill (*in press*).

Paired comparison/rank-ordering methods have mainly been applied to the problem of comparing or maintaining standards across different tests or examinations that have been marked in the usual way. However, a far more radical use of paired comparisons/rank-ordering has been proposed by Alastair Pollitt – as an alternative to conventional marking (e.g. Pollitt, 2004; further examples in bibliography). An assumption within this is that the resulting scale is, in some situations, more valid than the raw score scale that results from conventional marking. In this scheme, both marking and standard maintaining (setting of grade boundaries) can be carried out in a single, coherent, judgement-based process. Paired comparison/rank-order judgements of work from the same examination create the scale that replaces conventional marking. Involving some pieces of work from previous examinations can 'anchor' the scale to previous scales – and hence maintain standards. In principle – although trammelled by practical problems – work from other examinations (e.g. those from other boards) could also be incorporated to ensure comparability across facets other than time.

## Prototype developments in qualifications

The E-scape project led by Richard Kimbell and colleagues at Goldsmith's University (e.g. Kimbell, 2007) is a very well-funded enterprise (~ £1.8 million over its 3 stages so far) where rank-order approaches to marking are being incorporated at a larger scale than would be possible in most research exercises. The E-scape project is innovative in a number of ways, in particular for its use of technology and its attempts to achieve more valid assessment of creativity and the design process (within Design & Technology assessment). The assessment requires the creation of electronic portfolios of evidence, which are then assessed by experts using paired comparisons and rank-ordering via a customised on-line interface. So far it has been used to assess parts of GCSE Design & Technology, GCSE Geography fieldwork and GCSE science practicals

(all in non-'live' pilot projects). It is also being used in several other contexts such as formative and peer assessment (see bibliography).

## State of play

Innovation and openness to new ideas are fundamental to the core values of Cambridge Assessment, and the use of paired comparisons and rank-ordering in the assessment process appears to hold considerable potential. However, we are also committed to providing good evidence to support any innovations we introduce. As can be seen in the bibliography below, we have investigated and are continuing to investigate both the technical/statistical aspects of the methods, and the underlying psychology of expert judgement that they depend upon.

Research is needed in order to evaluate the quality of assessment outcomes based entirely on paired comparison or rank-order judgements, and to identify the circumstances in which these outcomes are 'better' than those produced by conventional marking. The assumptions, underlying processes, and operational issues associated with using paired comparison/rank-order judgements in public examinations require further scrutiny. Crucially, the judgement process moves more towards a 'black box' model of assessment – something which is contrary to the direction in which assessment has been developing. In addition, the increasing demand from schools, pupils and parents for detailed feedback on performance becomes problematic under such arrangements. In terms of validity, 'better' means making the case that the paired comparison/rank-order outcome supports more accurate and complete inferences about what the examinees know and can do in terms of the aims of the assessment. In terms of reliability, 'better' means showing that the paired comparison/rank-order outcomes are more replicable with different judges (markers) or different tasks (questions). In terms of practicality, we need to show that replacing marking with paired comparison/rank-order judgements is technologically, logistically and financially feasible. In terms of acceptability, 'better' means showing that examinees and other stakeholders are more satisfied with the fairness and accuracy of paired comparison/rank-order assessment outcomes, and the information from the assessment meets school, candidate and user requirements. In terms of defensibility, 'better' means showing that it is easier for examination boards, when challenged, to justify any particular examinee's result (which clearly could be a significant challenge for a system based entirely on judgement with no equivalent of a detailed 'mark scheme').

In conclusion, Cambridge Assessment is a sophisticated user and developer of rank-ordering methods and has been, and continues to be, actively involved in research into the validity of using paired comparison/rank-ordering methods in the assessment process. Our current position is that they are best deployed in standard-maintaining contexts, when the assessments being compared are as similar as possible (e.g. examinations from the same board in the same subject in consecutive examination sessions). We are actively exploring their applicability to more general investigations of comparability and to mainstream qualifications and assessments.

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## STANDARDS

# A better approach to regulating qualification standards

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*In light of the forthcoming Government White Paper on education due out in Autumn 2010, Cambridge Assessment explains here how new patterns of engagement between those concerned with the creation and use of assessments can lead to the better regulation of public examinations. This viewpoint was posted on the Cambridge Assessment website in September 2010.*

## The question of standards

The original purpose of public examinations (created in the mid-nineteenth century, mainly by universities) was to drive up standards at the lower levels of education and provide a stream of potential undergraduates. Grammar Schools and the Headmasters' and Headmistresses' Conference (HMC) Schools used them to certificate the learning being delivered. Subsequently, the Government required them to ascertain it was getting value for the money it spent on schools. That original purpose still stands today.

Exams have become crucial both for entry to a Higher Education (HE) sector taking nearly 50% of the cohort each year and for securing the bulk of jobs with progression prospects. In the late 1990s a more businesslike attitude took root among the exam boards, a school accountability framework based on exam results was introduced and, in 2002, a commercial exam board was introduced into the system.

This led to fears that boards could be lowering standards in order to achieve market share. The reality is that the aggregate market share of the boards has remained remarkably constant since the introduction of Curriculum 2000. Nevertheless, the question for the new century has changed from measuring whether education is good via examinations to whether the examinations in themselves are a good measure of that education.

## Why there is a problem

Over the past forty years, exam boards became ever more concerned with technical accuracy while 'users' of qualifications such as HE and employers became more concerned with other issues. As a consequence, the British state ended up disintermediating subject communities, HE,

professional societies, employers, teachers and those developing and providing examinations by taking upon itself the role of defining the content of syllabuses and the way in which they were examined. Thus, 'users' were divorced from 'producers'. Producers have continued to carry out a difficult and arcane task with ever increasing accuracy but with little direct contact with users to help them re-balance that precision with some healthy macro overviews of the purpose of the exercise.

## The current situation

The last Government sought to address the question of standards by setting up a new regulator, the Office of Qualifications and Examinations Regulation (Ofqual), which has a more clearly defined role than its predecessor, the Qualifications and Curriculum Authority (QCA). The Coalition Government has made it clear that it does not regard this as being the best way of ensuring standards are maintained and has committed to legislation giving Ofqual the powers it needs to enforce rigorous standards.

Ministers have already stated that they are not interested in the direct regulation of 'products' and are abolishing Ofqual's partner quango, the Qualifications and Curriculum Development Agency (QCDA). The QCDA is currently responsible for defining qualification (design) criteria – such as the number of units, the grading structure and methods of assessment – and subject (content) criteria.

The regulator is likely to be most effective if it is allowed to focus on a specific objective, rather than a collection of objectives which it currently holds. Narrow and deep regulation creates a more effective regulator than a broad and superficial approach.

## How can standards best be maintained?

- 1 Users need to take the major role in specifying the content criteria of qualifications – enabling them to help set the standards.
- 2 Exam boards need to agree between themselves on design criteria – enabling them to set and maintain the standard in relation to each other.