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TALEGENT GAMIFY WHITEPAPER

# Assessment is No Game... Or Can It Be?

Evaluating Gamified Assessment for Measuring Cognitive Ability



# Executive Summary

Long-awaited by the HR community, gamified assessments have finally arrived. Analysing the results of the administration of a gamified assessment by a world-leading Australian professional services firm to over 12K graduates indicates that this new form of assessment provides a more positive and engaging experience than traditional assessments. At the same time, response data shows that gamified assessments are capable of delivering valid and reliable measures of cognitive ability, plus are especially well-suited for measuring Learning Agility.

## Background

### The rise of gaming

Gamification has been a hot topic within business circles for years. The rapid emergence of the digital gaming industry—expected to hit \$100 billion in worldwide revenue this year—is a testament to the human appetite for interactive tests of skill and/or knowledge, and instant feedback via a reward system of points or digital prizes.

### Employment of gamification by business

No surprise then, that business has sought ways to harness our propensity for gaming for their own ends. Gamification has already been harnessed for motivating desired behaviors in customer loyalty, employee motivation, and other programs. In fact, gamification has consistently topped the list of upcoming tech trends in HR for the last several years. Now, that promise appears to be coming to fruition with the recent introduction of game-based talent assessments.

### Introduction of game-based assessments

There now exist a small number of assessments that employ a game interface for the purpose of measuring a candidate's abilities. Their key defining characteristic is that they are interactive. The test-taker (or game-player) performs certain actions in pursuit of a given goal, and gets instant feedback on the impact of those actions, which in turn could inform their subsequent actions. In other words, through playing, one can learn to “master” the game.

### Assessing gamified assessments

It is believed that the combination of interactivity, entertainment value and novelty could provide greater attraction and engagement for new entrants to the workforce who grew up within a digital/online landscape and have thus come to expect more interactive experiences.

Leveraging game elements and narrative, gamified assessments appear to provide an opportunity to create a more positive experience for candidates.

Regardless of their powers of engagement, the fundamental question remains: Can a gamified form of assessment measure competencies proven to predict performance with the same degree of validity and reliability as traditional, question-based assessments?

Further Learning Agility has recently emerged as a key competency that positively correlates with high job performance. Defined as the “ability to learn from experiences and to apply that learning to new and different situations,”<sup>1</sup> learning agility determines the speed at which one learns. Since its inception by Lombardo and Eichinger<sup>2</sup> learning agility has shown remarkable momentum in management research with some suggesting that learning agility is a stronger predictor of future success than even previous performance<sup>3</sup>. It is assumed that by virtue of their interactive format, gamified assessments provide candidates an opportunity to learn thus allowing a better opportunity to measure Learning Agility than is possible with static tests. But do the facts bear out this assumption?

## Objectives

The purpose of this study is to determine the answers to the following questions:

1. Can gamified assessments provide higher level engagement than traditional assessments?
2. Can a gamified assessment measure key competencies to the same degree of accuracy as traditional assessments?
3. Does their interactive format allow gamified assessments the capability to provide a more meaningful measure of Learning Agility?

# Methodology

Talegent was engaged by one of the world's largest, best-known professional service companies who assesses large volumes (10K+) of graduates for recruitment purposes. They requested us to create a gamified assessment which could accurately and reliably measure a key cognitive ability that would be relevant and predictive of job performance for a range of entry level positions. Their intended use for this gamified assessment was to serve as a meaningful initial screen of job candidates, while also providing an opportunity to provide a differentiated experience that would support their unique employer brand.

We delivered a dynamic logical reasoning game which required candidates to manipulate graphic elements to produce a defined desired outcome. The "game" allows for candidates to experiment in applying certain operators to observe the outcome produced, to learn how to apply them to achieve a desired outcome.

This gamified assessment was administered by the client company, and 12558 completions were received. Test metrics, assessment scores and feedback from this initial experience have been used to provide answers and insights into our three stated objectives for this study.

## Findings

### 1 Dropout rate and candidate feedback indicate a higher level of engagement than is typical for traditional assessments

For the purposes of comparison, we matched the gamified campaign with a traditional recruitment campaign, based on the following key characteristics:

- Graduates
- Australian Organisation
- Well regarded brand

We found a campaign which shared 31.17% of its candidates with the gamified recruitment campaign. Comparing the two, we found the traditional assessment had an almost 12X greater dropout rate.

Interestingly, a small number of applicants who had dropped out of the traditional campaign (N = 61) were sent the gamified assessment. The vast majority of these (98.4%) completed the gamified assessment.

We believe it is safe to conclude that the lower dropout rate for the gamified assessment is a meaningful measure of its ability to drive higher engagement in that more candidates remained motivated enough to complete it. But the overwhelmingly positive feedback received from candidates who went through the gamified assessment provides further evidence.

Representative comments include:



"The online testing... very cool and different which I enjoyed"

"The test was pretty enjoyable"

"Had a lot of fun in the testing, prefer this to any other type of testing"

"Yep loved this type of test"

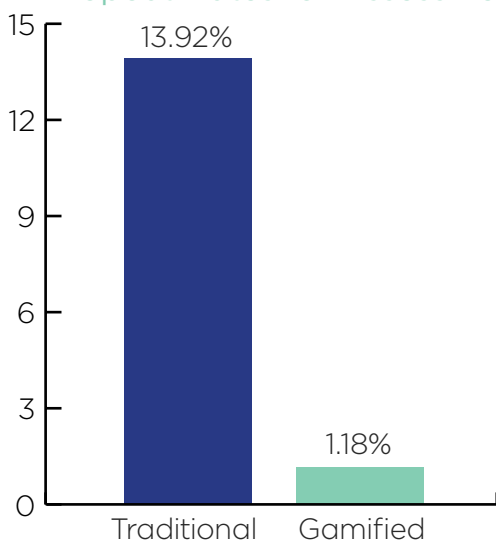
"The test was pretty enjoyable imo. All about logic no comprehension or maths bull lol..."

"I did my online test yesterday, thought it was quite fun actually"



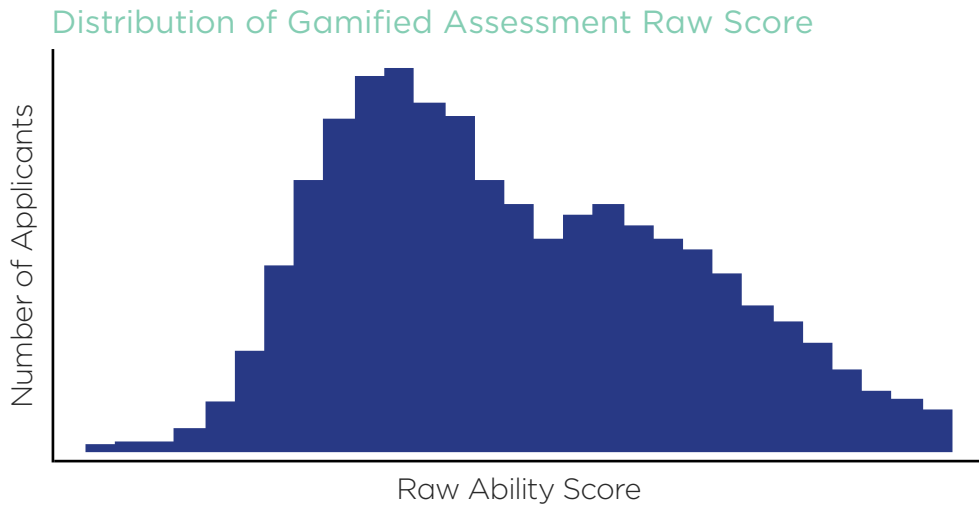
It is no exaggeration to say that almost no candidates report traditional assessment tests as "fun." Certainly the primary goal for an assessment test is to generate valid measures of a candidate's abilities, not entertain them. However, an assessment that is perceived as fun will attract more candidates to take the test and keep them motivated to complete it, plus create a more positive candidate experience that will reflect favorably upon the employer.

Dropout Rates for Assessment



## 2 Based on scoring data, gamified assessments do have the capability to measure key competencies with the same degree of reliability and validity as traditional assessments

The gamified assessment was administered too recently to be able to relate test scores to eventual on-the-job performance. However, looking at the scoring data produced by the gamified assessment shows the same level of consistency as traditional assessments. For example, the distribution of raw scores is in line with traditional testing outcomes.



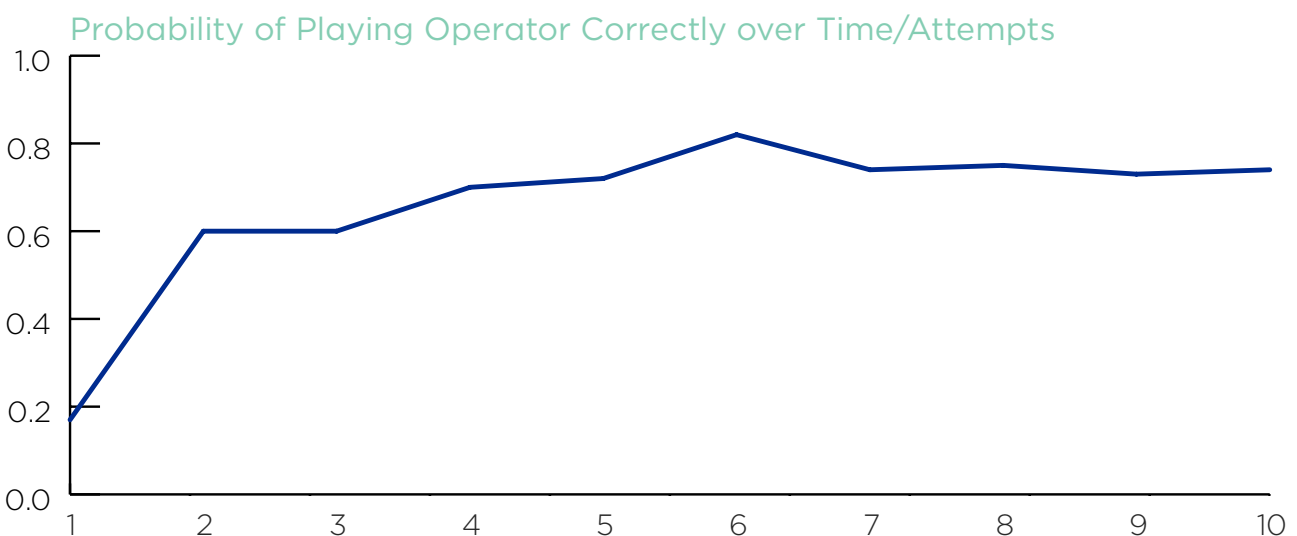
Further, the gamified assessment provided logical reasoning scores that showed the same correlations to other cognitive ability scores as one finds in traditional tests.

	Gamified	Verbal	Numeric	Logical
Gamified	1.00	0.11	0.42**	0.41**
Verbal	0.11	1.00	0.40**	-0.02
Numeric	0.42**	0.40**	1.00	0.20*
Logical	0.41**	-0.02	0.20*	1.00

\*\*<0.05, \*=0.05

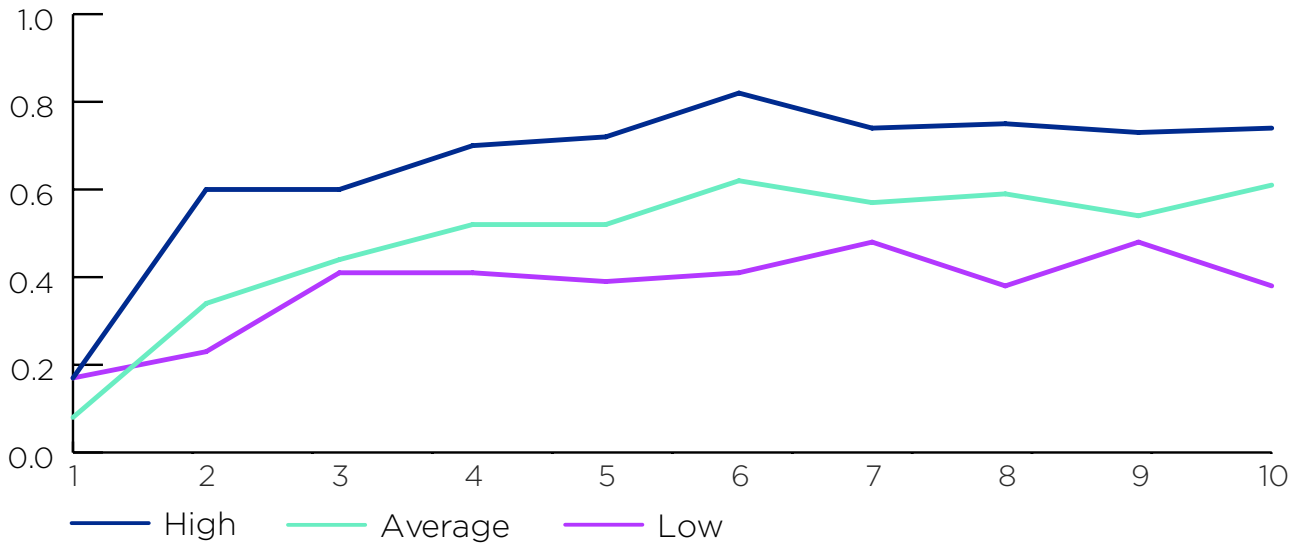
## 3 Gamified assessments do provide the opportunity to obtain meaningful measure of Learning Agility

Unlike traditional assessments, the gamified assessment observed in our study allowed candidates the opportunity to experiment and learn. The fact that they are learning, and the speed at which they are learning, is observable in their response data.



From an overall/aggregate perspective, candidates' ability to provide correct solutions improved as their experience with the gamified test increased. But looking at more granular level, we found that the speed at which their scores improved were not uniform. Some learned and improved faster and others slower.

### Improvement in Responding Correctly with Experience Varied

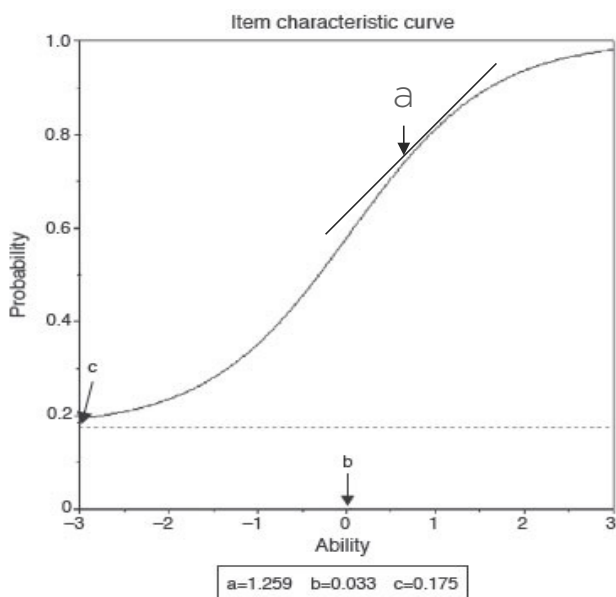


This observable difference in the speed at which respondents learned can be taken as a measure of their Learning Agility, which by its definition is an indicator of the speed at which one learns. So from the response data we see, some applicants show high levels of learning agility and learn the dynamic systems quickly, while other applicants take more experimentation attempts to learn.

But to derive a practical measure for Learning Agility, requires a modification to the existing Item Response Theory (IRT) model that is well supported and widely used for the estimation of an ability on cognitive reasoning assessment. IRT models that the probability of answering an item correctly is a function of a candidate's ability ( $\theta$ ), the item difficulty ( $\delta$ ), item discriminability ( $\alpha$ ), probability of guessing item ( $c$ ).

### Item Response Theory Model

$$p(x = 1|\theta, \alpha, b, c) = 1 + (1 - c) \frac{e^{\alpha(b-\theta)}}{1 + e^{\alpha(b-\theta)}}$$



But with the Gamified assessment we saw that a candidate's probability of placing an operator correctly was a function of experience with an operator. In other words, the gamified assessment provided candidates with an opportunity to learn, and their learning was evident in their scores. Change in ability over time is not something one typically sees with traditional static assessment tests and is not something that is accounted for in the standard IRT model. However, it can be easily and soundly adapted to do so.

To account for candidates learning through experimentation, we can add an additional parameter ( $\gamma$ ). The amount of acquired learning ( $\gamma$ ) is a function of the operators initial uncertainty ( $\tau$ ), number of trials an applicant has had ( $\eta$ ) and the speed that the candidate acquires learning ( $\lambda$ ). The impact of operator uncertainty decays as candidates experiment with the operator at an exponential rate determined by the candidate's learning agility ( $\lambda$ ).

### Deriving Learning Agility via Dynamic IRT

$$p(x = 1|\theta, \alpha, b, c, \gamma) = 1 + (1 - c) \frac{e^{\alpha(b-\theta-\gamma)}}{1 + e^{\alpha(b-\theta-\gamma)}}$$

$$\gamma = \tau(e^{-\lambda\eta})$$

# Gamified Assessment with Dynamic IRT is a Reliable Predictor of Candidate Ability

So how well does our Gamified assessment with Dynamic IRT model fit the data from our sample?

To find the answer:

- We initially estimated the item parameters using a MCMC estimator with Metropolis-Hastings method. We ran the estimator from four random start points with a burn in of 1000 runs and took the final 10,000 runs.
- We then checked the convergence of the parameters through analysing the within random start variance compared to the between random start variance with an ANOVA.
- The item parameters were then used to estimate the participant parameters through the expected A posteriori method with the Dynamic IRT model as the likelihood function.

This process provided us with a measure of the standard error of estimation for the candidate ability which we used to calculate the reliability. From this analysis of the data, we concluded that the Gamified assessment showed appropriate levels of reliability for a short 10-minute reasoning assessment.

## The Reliability of the Gamified Assessment

$$Reliability(\theta) = \frac{var[\hat{\theta}] - var[SE(\theta)]}{var[\hat{\theta}]}$$

$$Reliability(\theta) = 0.78$$

Item parameter estimates were estimated through the Metropolis-Hasting (MCMC) method.

The dynamic item response theory model was fit to candidate data (n = 12,558) with the EAP method.

This provides a measure of the  $SE(\theta)$  which can be used to find the reliability.

## Conclusions

From this study of the administration of a dynamic logical reasoning gamified assessment to over 12K graduates, we found clear indications of higher engagement vs. traditional assessments in the form of significantly lower dropout rates and overwhelming positive responses provided by the graduate candidates themselves.

Our study of the response data also showed that gamified assessments are a sound testing format. Response data shows that they can measure similar abilities to traditional cognitive ability assessments, with the same degree of validity and reliability. Further, because gamified assessments provide an interactive experience in which learning takes place, they are particularly well-suited to providing a meaningful and valid measure of Learning Agility.

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