He aratohu hangarau
Technical guide

PAT Pānui
PAT Reading Comprehension

The refreshed PAT Pānui assessments are available online through NZCER Assist (https://www. nzcerassist.org.nz/login).

The previous version of the PAT Reading Comprehension assessments (paper-based and online) will not continue to be supported from 2025.

Mō ngā pātai me ngā tohutohu For questions or advice

E-mail assessmentservices@nzcer.org.nz or call Assessment Services on (04) 802 1630

Mō te tautoko me ngā raraunga puta noa i te kura For support with school-wide data

E-mail educationadviser@nzcer.org.nz or call Education Advisers on (04) 802 1386

Kupu whakataki Introduction

This technical guide had two purposes:

1. To describe the processes used to develop and validate the refreshed PAT Pānui | Reading Comprehension (PAT Pānui) assessments.

2. To provide an overview of the psychometric properties of the refreshed PAT Pānui tests.

The guide is intended for teachers, principals, administrators, and other users of the PAT Pānui test. It complements the information provided in the PAT Pānui kaiako guide.

He aha ngā whakamātautau PAT Pānui kua whakahoutia?
What are the refreshed PAT Pānui tests?

The PAT Reading Comprehension tests have been updated and refreshed to produce a new set of tests. The content has been renewed, the overall look of the tests updated, and additional design features added to make the tests more accessible and inclusive of a broader range of ākonga. Seven comprehension tests are designed for use with ākonga in Years 4 to 10. The tests can be administered online and used with classes or with individuals. (Paper tests will be available for use in 2025.) Results from the new tests can still be compared with results from the 2008 version.

The NZCER Assist platform (https://www.nzcerassist.org.nz/login) is used to manage the administration, marking, and reporting of the test. The platform can be used to generate a wide range of reporting at the individual, group, and school level. Scores from each of the tests can be converted to a location on the PAT Pānui comprehension (*patc*) scale, which is also qualitatively described. This means that scale scores can be linked to a description of the kinds of reading comprehension capabilities that are typically associated with scoring at different parts of the scale. Scale scores are supplemented with normative information in the form of stanines so that test results can be compared with the scores of a nationally representative reference group at specific year levels.

Te whakarewanga tuatahi Piloting

Before the PAT Pānui trial an extensive development and piloting process was completed. This consisted of the following components.

1. Reviewing existing PAT Reading Comprehension materials to determine which texts and questions needed updating or replacement.

2. Drafting replacement texts and associated questions. This included input and systematic reviews from subject matter experts with knowledge and understanding of ākonga Māori and Pacific learners.

3. Small-scale piloting of the first round of materials, including pilot assessments and user experience questionnaires for students and teachers.

4. Psychometric analysis of pilot assessment data, statistical analysis of user experience data, and incorporation of these into the refinement of the materials.

5. Small-scale piloting of the refined materials, again including pilot assessments and user experience questionnaires for students and teachers.

6. Psychometric analysis of pilot assessment data, statistical analysis of user experience data, and incorporation of these into the further refinement of the materials.

This development and piloting process ultimately contributed to a collection of texts and associated questions that were already of good quality before any medium-scale trials.

Te whakamātautau Trialling

The material developed through the piloting process described above was used in a large-scale trial in 2023. The purpose of the PAT Pānui trial was to use draft test materials to collect enough data to allow psychometric analysis of those materials. This makes sure that the final tests, texts, and items are psychometrically robust, and that the tests are appropriately targeted. An important aspect of the trial was to calibrate the new material onto the PAT Pānui Rasch measurement scale. This would allow student performance on the new material to be compared both with performance on the existing PAT Pānui assessments and with the existing national norms. Note that the trial was not designed to establish new norms.

Ngā raraunga whakamātautau Trial data

A total of 4,305 students across 36 schools participated in the PAT Pānui trial. Of these 36 schools:

- 18 were high SES (decile[1] 8, 9, 10, or private schools in 2022)
- 10 were mid SES (decile 4, 5, 6, or 7 in 2022)
- 8 were low SES (decile 1, 2, or 3 in 2022).

Different students were administered different test forms. There were three types of forms.

1. Test forms 1, 2, 3, 4, 5, 6, and 7 were intended to be draft versions of the refreshed PAT Pānui tests.

2. Test forms 1.5, 2.5, 3.5, 4.5, 5.5, and 6.5 were intended to support item analysis and vertical linking of the PAT Pānui tests. Test form 1.5 was made up of half of test form 1 and half of test form 2; test form 2.5 was made up of half of test form 2 and half of test form 3; and so on.

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[1] Decile was used as a proxy for socioeconomic status because this was what was available as an socioeconomic indicator at the time the sample was drawn. The equity index became available for use shortly thereafter.

3. Test forms 1m, 2m, 3m, 4m, 5m, 6m, and 7m were intended to support linking of the new PAT Pānui tests with the existing ones. Test form 1m was made up of half of test form 1 and half of the existing PAT Reading Comprehension Test 1; test form 2m was made up of half of test form 2 and half of the existing PAT Reading Comprehension Test 2; and so on.

Table 1 and Table 2 describe the PAT Pānui trial data. Table 1 describes the distribution of students by school socioeconomic status and year level. Table 2 describes the distribution of students by school year level and test form. Table 1 and Table 2 show that:[2]

- students from high socioeconomic status schools made up the largest proportion of participating students
- several hundred students participated in the trial from each of year levels 4 to 10
- year level 9 had the fewest participating students, and year level 5 the most.

Ripanga 1 Tauanga o ngā ākonga mā te tūnga ohapori (SES) me te taumata ā-tau

Table 1 Count of students by school socioeconomic status (SES) and year level

Year level	Low SES (deciles 1, 2, 3)	Mid SES (deciles 4, 5, 6, 7)	High SES (deciles 8, 9, 10, NA)	Total
4	100	139	437	676
5	171	202	380	753
6	153	165	390	708
7	94	162	349	605
8	107	217	378	702
9	107	71	182	360
10	113	103	285	501
Total	845	1059	2401	4305

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2 The PAT Pānui trial data contained one student record from a student who reported being in Year level 3. This student's data is included with that of students in Year level 4.

Ripanga 2 Tauanga o ngā ākonga mā te taumata tau me te puka whakamātautau

Table 2 Count of students by year level and test form

Test form	Year level 4	Year level 5	Year level 6	Year level 7	Year level 8	Year level 9	Year level 10	Total
1	213	0	0	2	0	0	0	215
1.5	254	212	4	0	0	0	0	470
1m	209	1	1	0	0	0	0	211
2	0	209	1	0	0	0	0	210
2.5	0	138	136	0	0	0	0	274
2m	0	192	2	1	0	0	0	195
3	0	0	208	0	0	0	0	208
3.5	0	0	144	120	1	0	0	265
3m	0	0	212	0	0	0	1	213
4	0	1	0	192	1	1	0	195
4.5	0	0	0	118	120	0	0	238
4m	0	0	0	166	0	0	0	166
5	0	0	0	5	298	0	0	303
5.5	0	0	0	0	81	90	0	171
5m	0	0	0	1	201	0	0	202
6	0	0	0	0	0	100	1	101
6.5	0	0	0	0	0	77	157	234
6m	0	0	0	0	0	92	0	92
7	0	0	0	0	0	0	211	211
7m	0	0	0	0	0	0	131	131
Total	676	753	708	605	702	360	501	4305

Tātaritanga tūemi Item analysis

A range of psychometric analyses were applied to the PAT Pānui trial data (from all test forms) to ensure that the quality of the new items and tests was high.

We analysed:

- item discrimination—the extent to which each item is able to distinguish between students' reading comprehension

- distractor performance—the extent to which distractors (incorrect response options) are selected across a range of student comprehension levels
- the distribution of item difficulties by test—the spread of item difficulties across a test relative to student reading comprehension levels
- differential item functioning—the extent to which each item functions differently for different groups of students.

Three items were removed from the PAT Pānui tests prior to calibration and linking because of poor performance in one or more of these analyses. A small number of the remaining items had minor edits prior to calibration and linking.

Te tauine me te hononga Calibration and linking

We used a test-by-test approach to undertake a Rasch measurement[3] calibration of test forms 1–7.

First, an initial measured difficulty of each item in test form 1—relative to the other items in test form 1—was fixed. This was achieved using a Rasch analysis of the data associated with test forms 1 and 1m. The items in test form 1m were included to enable linking with the existing PAT Reading Comprehension scale as described below.

The analogous process was applied to the items in each of test forms 2–7.

Next, test form 1 was linked to the existing PAT Reading Comprehension scale. That is, the initial measured difficulties of the items in test form 1 were located on the existing PAT Reading Comprehension scale as follows:

1. For existing items in the test forms 1 and 1m, the existing item difficulties and the initial measured difficulties described above were compared (after translating the means of both sets of difficulties of these items to equal 0).

2. Those items with similar enough new and existing shifted difficulties were designated as "linking items".

3. The translations required to shift the means of both sets of difficulties of the linking items to equal 0 were then used to translate the initial measured difficulties of all items in test form 1 to their final calibration on the existing PAT Reading Comprehension scale.

This was repeated for the items in test forms 2 and 2m, for the items in test forms 3 and 3m, and so on.

After all items had been located on the PAT Reading Comprehension scale, a small number of items were shifted between tests to ensure that each test form was well targeted to its intended year level.

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3 By "Rasch measurement" we mean an application of the dichotomous Rasch model to this test data, and in particular, the resulting item difficulty calibrations. To learn more about the Rasch model, see, for example, Bond, T. G., & Fox, C. M. (2007). *Applying the Rasch model: Fundamental measurement in the human sciences* (2nd ed.). Lawrence Erlbaum Associates Publishers.

Te tohanga ā-motu o te ekenga paetae ākonga National distributions of student achievement

Table 3 shows the national distribution of achievement in PAT Pānui for each of student year levels 4–10. These were established in the previous version of the PAT: Reading manual.[4] In the table, "N students" refers to the number of students used to estimate the corresponding mean and standard deviation.

Ripanga 3 Te tohanga o te ekenga paetae ākonga mā te taumata ā-tau
Table 3 Distributions of student achievement by year level

Year level	Mean (*patc*)	SD (*patc*)	N students
4	28.8	15.2	1442
5	35.8	13.2	1432
6	45.0	12.7	1439
7	53.2	12.6	2086
8	60.4	12.3	1814
9	67.0	12.2	2204
10	76.5	12.4	1903

Ngā āhuatanga o ngā puka whakamātautau i whakaotingia 1–7 Properties of finalised test forms 1–7

Table 4 shows the psychometric properties of the finalised test forms (following item analysis, calibration, and linking). It shows:

- Cronbach's Alpha (KR-20)—a measure of the internal consistency reliability based on student total scores
- Rasch person reliability—a measure of the internal consistency reliability based on student scale scores
- Average percent correct—the average, for all students attempting the test form, of the percentage of the items each student answered correctly
- N items—the number of items in the finalised test form
- Mean item difficulty (*patc*)—the average measured difficulty of the items in the test form
- SD item difficulty (*patc*)—the standard deviation of the measured difficulties of the items in the test form.

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4 Darr, C., McDowall, S., Ferral, H., Twist, J., & Watson, V. (2008). *Progressive Achievement Test: Reading, Teacher manual* (2nd ed.). Wellington: New Zealand Council for Educational Research.

Ripanga 4 Ngā āhuatanga ine hinengaro o ngā puka whakamātautau i whakaotingia 1–7

Test form	Cronbach alpha (KR-20)	Rasch person reliability	Average percent correct (%)	N items	Mean item difficulty (*patc*)	SD item difficulty (*patc*)
1	0.90	0.88	58.6	36	27.3	7.8
2	0.89	0.86	64.0	36	35.7	7.9
3	0.84	0.81	68.4	35	43.8	10.8
4	0.92	0.89	55.9	41	51.4	6.4
5	0.91	0.89	59.2	41	56.4	7.3
6	0.94	0.91	58.2	41	61.2	8.8
7	0.91	0.89	63.1	42	71.2	7.3

Table 5 shows the mean difficulty and number of items for the existing PAT: Reading Comprehension tests and those for the refreshed PAT Pānui tests.

Ripanga 5 Uauatanga whakamātautau toharite o ngā whakamātautau PAT Pānui kua whakahoutia, ina whakaritea ki ērā atu whakamātautau

Table 5 Mean test difficulty of refreshed PAT Pānui tests compared with existing tests

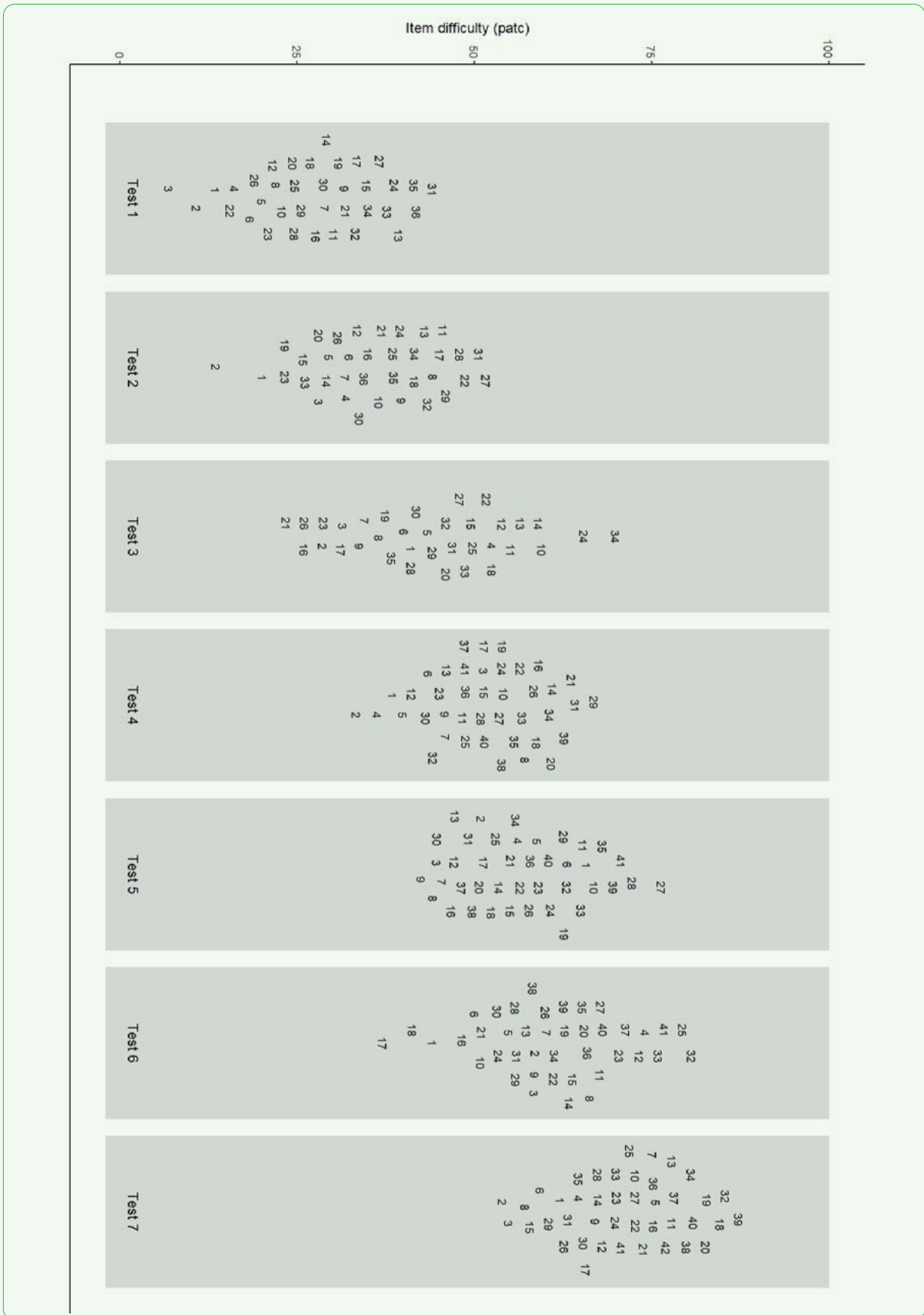| Test form	PAT: Reading Comprehension		Refreshed PAT Pānui	
	N items	Mean item difficulty (*patc*)	N items	Mean item difficulty (*patc*)
1	33	24.4	36	27.3
2	37	34.2	36	35.7
3	35	41.3	35	43.8
4	37	49.4	41	51.4
5	38	57.3	41	56.4
6	42	64.8	41	61.2
7	42	71.4	42	71.2

Overall, Table 5 shows that the refreshed tests are very similar to the existing tests in terms of mean item difficulty and number of items.

Figure 1 shows the item difficulties by test form. For instance, Item 2 is the easiest item contained in test form 7 and Item 31 the most difficult item in test form 1.

Figure 2 shows the item difficulties according to the text they are associated with and the test form they are in. For example, the text *Baby Jack* is the second text students will meet in test form a. It involves four items (items 6, 7, 8, and 9). Of these, item 9 is the most difficult. In Figure 2, the vertical locations of some questions have been shifted slightly to avoid overlap.
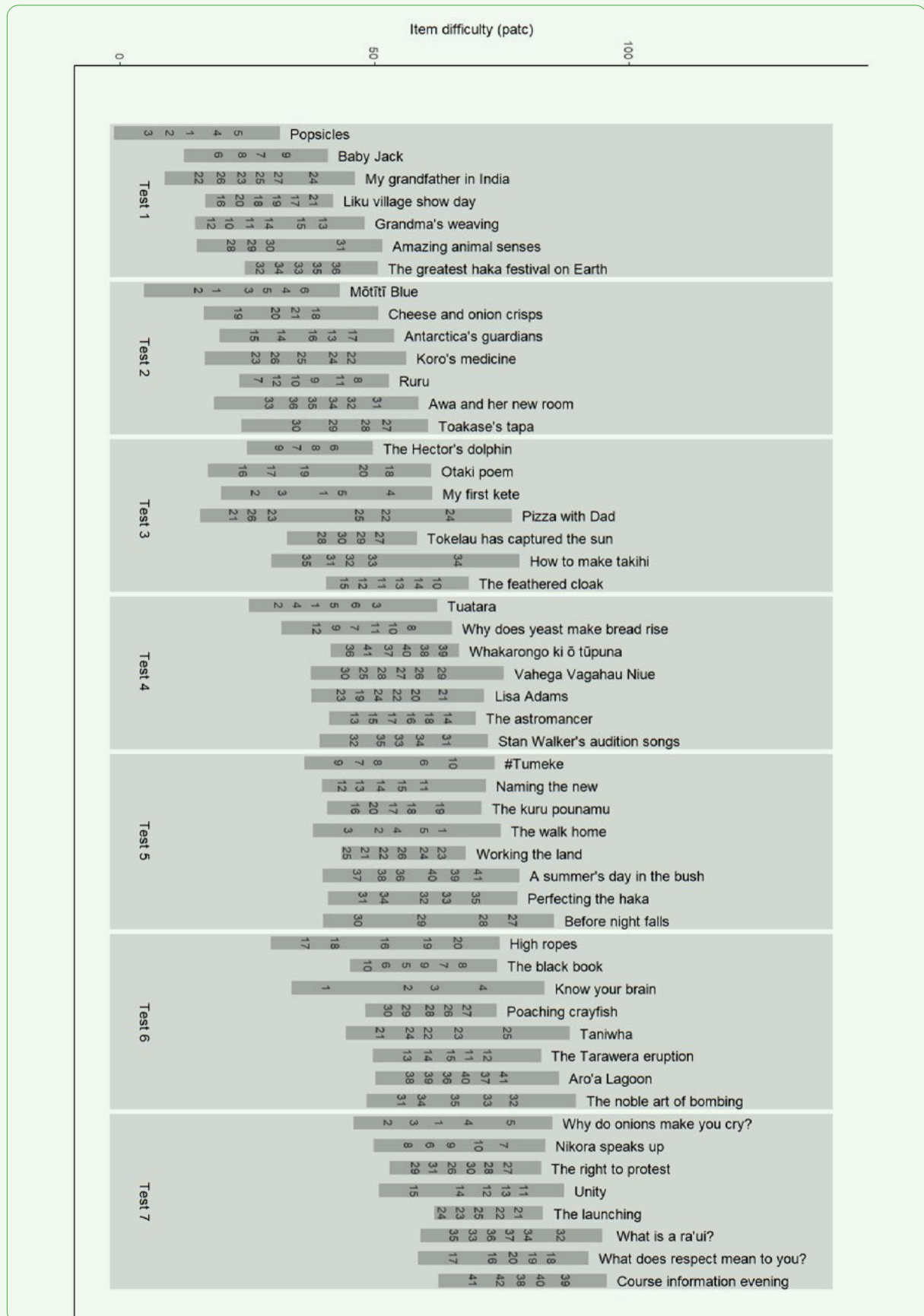
Pikitia 1 Ngā uauatanga tūemi mā te puka whakamātautau

Figure 1 Item difficulties by test form

Pikitia 2 Ngā uauatanga tūemi mā ngā kuputuhi me te puka whakamātautau

Item difficulty (patc)

Test 1
- Popsicles
- Baby Jack
- My grandfather in India
- Liku village show day
- Grandma's weaving
- Amazing animal senses
- The greatest haka festival on Earth

Test 2
- Mōtītī Blue
- Cheese and onion crisps
- Antarctica's guardians
- Koro's medicine
- Ruru
- Awa and her new room
- Toakase's tapa

Test 3
- The Hector's dolphin
- Otaki poem
- My first kete
- Pizza with Dad
- Tokelau has captured the sun
- How to make takihi
- The feathered cloak

Test 4
- Tuatara
- Why does yeast make bread rise
- Whakarongo ki ō tūpuna
- Vahega Vagahau Niue
- Lisa Adams
- The astromancer
- Stan Walker's audition songs

Test 5
- #Tumeke
- Naming the new
- The kuru pounamu
- The walk home
- Working the land
- A summer's day in the bush
- Perfecting the haka
- Before night falls

Test 6
- High ropes
- The black book
- Know your brain
- Poaching crayfish
- Taniwha
- The Tarawera eruption
- Aro'a Lagoon
- The noble art of bombing

Test 7
- Why do onions make you cry?
- Nikora speaks up
- The right to protest
- Unity
- The launching
- What is a ra'ui?
- What does respect mean to you?
- Course information evening

Figure 2 Item difficulties by text and test form

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