

**Technical Report # 13
Assessment Tools for Teaching and Learning**



Pāngarau Curriculum Framework & Map:

Levels 2—4

Submitted by the Assessment Tools for Teaching and Learning team,

Auckland UniServices Ltd

University of Auckland

June 2002

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This report details the Level 2-4 asTTle Pāngarau Framework and provides a detailed breakdown of curriculum achievement objectives by curriculum level. asTTle is funded by the Ministry of Education to Auckland UniServices at the University of Auckland to research and develop an assessment application for Reading, Writing, Mathematics, Pānui, Pāngarau, and Tuhituhi for Years 5-7 (Levels 2-4) for New Zealand schools. We acknowledge this funding, and thank the Ministry of Education for their continued assistance in the development of this project.

We especially acknowledge Mr. Uenuku Fairhall, principal of Te Kura Kaupapa Māori o Te Koutu, Rotorua, for outlining his interpretation of how curriculum achievement objectives proceed from levels 2 to 4, and for providing the pāngarau overview map. Uenuku informed us that the Pāngarau Curriculum has its genesis in the equivalent English mathematics curriculum and that the achievement objectives and curriculum frameworks are in most cases near equivalent translations. He is a recognised expert in the teaching of pāngarau and has been heavily involved its development.

Dr. Ian Christensen (Massey University) and Mr. Tony Trinick (Auckland College of Education) provided feedback and critiques on Uenuku's work. Mr. Peter Keegan has worked closely with the development team, responding to their ideas, providing details on the asTTle development, and reflecting on how the curriculum map affects the asTTle development.

This report is the first in a series of reports on the Pāngarau Curriculum to which a wide range of curriculum experts have responded, whom I would also like to thank for readily providing feedback and analysis.



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June, 2002

The bibliographic citation for this report is:

Fairhall, U. & Keegan, P. (2002, June). *Pāngarau curriculum framework and map: Levels 2—4*. asTTle Technical Report 13, University of Auckland/Ministry of Education.

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The Pāngarau Curriculum Framework and Map utilises insights produced by the mapping undertaken for mathematics for use in asTTle (Ell, 2001). The Pāngarau Curriculum Statement (Ministry of Education, 1996) was derived from the Mathematics Curriculum Statement (Ministry of Education, 1992). The Pāngarau Curriculum contains the same structure, in terms of content areas, levels, strands, achievement objectives and aims, however, the writers of the Pāngarau Curriculum attempted to include Māori perspectives on mathematics particularly when suggesting classroom activities.

There is a paucity of research detailing the differences between the teaching of mathematics and pāngarau in terms of both classroom practice and curriculum implementation. In addition to this, little is known about what variation exists in the teaching of pāngarau throughout the country. Before detailing the Pāngarau Curriculum Framework it is necessary to provide some background on the development of the Pāngarau Curriculum (Ministry of Education, 1996). This document has provided a unique set of challenges for the team working the on the Pāngarau Curriculum Framework.

Background

Pāngarau developments prior to the release of the Pāngarau Curriculum, were ad-hoc, uncoordinated and undertaken by range of groups, some of which were sponsored by the Ministry of Education and its predecessor the Department of Education. As expected in any nascent development, there was a dearth of resources and those available were poorly disseminated. Many teachers developed their own resources and literally their own pāngarau vocabulary and language based on the available documentation and input from various groups including other teachers. Two important aspects of pāngarau, variation, and changes in vocabulary and language use have plagued developments and continue to do so today (see Barton & Fairhall, 1995; Barton, Fairhall, & Trinick, 1998; Christensen, 1998).

The Pāngarau Curriculum statement for Māori medium schools was published in 1996, following a trial in 1995. The Minister of Education required the curriculum to contain at least the same achievement objectives as the Mathematics Curriculum for mainstream schools. While this caused some dissension and concern that Māori knowledge was being ignored, the passage of time has perhaps resulted in more acceptance that, while the document does not make Māori knowledge explicit as part of the curriculum, it does not discount it, and allows communities to include this where they consider it appropriate, according to the environment, context, and ability of the school.

Some of the translations in the Pāngarau Curriculum are not always clear, nor easy to decipher. This is compounded by the use of technical pāngarau language containing a large number of neologisms, many of which have not appeared in other sources. The Pāngarau Curriculum statement advocates some changes in existing pāngarau terminology. As far as known the new pāngarau terminology has not yet been adopted by all pāngarau teachers. The statement was written in a *neo-meta-language* and contained hundreds of new academic and technical Māori vocabulary items. The curriculum writers had to create a meta-language, that is a language to describe language itself (and its associated neologisms) to describe technical aspects of the curriculum that had never been written about before in Māori. Not surprisingly the writers also

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attempted to standardise some of the existing pāngarau vocabulary, in particular the academic vocabulary (used by students) currently being promoted in Māori-medium classrooms.

The Pāngarau writers worked in isolation from other groups developing Māori curriculum statements. This has resulted in some variation in vocabulary between statements; for example, pāngarau uses the term *taumata* for levels, while te reo Māori statement uses the term *kōeke*. In addition, the curriculum statement uses alternative Māori terms for the same concept, for example, both *tau whakahau kore* and *tau kewha* are terms for irrational numbers. Several terms were used for practical problems, (e.g., *hopanga tūwaenga*, *hōpara wā*, *rapanga whitake*). The statement (as were all Māori curriculum statements) was finally reviewed by Te Taura Whiri, which resulted in further vocabulary changes, some of which the curriculum writers did not agree with. Te Taura Whiri published *Te Matatiki: Contemporary Māori Words* in 1996. Some of the mathematic terms in *Te Matatiki* were different to the pāngarau statement, for example, line of symmetry *tuaka hangarite* (curriculum), *rārangi hangarite* (Te Matatiki). The statement has other quirks and inconsistencies, for example, *tauanga* ‘statistics’ has 10 *taumata* ‘levels’; all the other strands have eight. This inconsistency has still not been explained.

The Pāngarau statement, with its meta-language, inconsistencies, and large numbers of new vocabulary items has not been well received by classroom teachers. It is difficult to read, which results in teachers referring to the equivalent English mathematics curriculum. Some teachers, who had been teaching pāngarau prior in the introduction of the curriculum, continue to use their own preferred vocabulary items. More recently trained teachers who have had some background in the new curriculum statements and have not had exposure to earlier developments may more readily accept curriculum recommendations. Finally, the Ministry of Education had commissioned Massey University to review the current curriculum vocabulary. This will result, no doubt, in further changes.

Development and Description of the Pāngarau Curriculum Framework

The asTTle Pāngarau Curriculum Framework was based on the asTTle Pāngarau Curriculum Concept Map and work undertaken in Mathematics (Ell, 2001; Thomas, Tagg, Holton and Brown, 2002). The map provides an interpretation of achievement objectives and a likely progression from levels two to four. Although, the achievement objectives in the map are re-written in language and vocabulary currently favoured by Fairhall (Table 1), this is not considered to be negative. As far as it is known few teachers have adopted or use the current curriculum language exclusively. Further, it is possible to clearly map the language of the Table 1 version to that of the current curriculum (Table 2). It is clear from comparing Table 1 to work undertaken in English that, as the curriculum statements are very similar, it is logical to expect the frameworks to be similar rather than contain many major differences.

The asTTle Pāngarau Curriculum Framework consists of four major headings (content areas) rather than eight as in asTTle Mathematics. Number and Algebra (*Tau* and *Taurangi*) are combined into one heading. The major reason for this is the current small number of pāngarau algebra items does not permit this to exist as a separate area. Clearly more items in this area need to be developed, and perhaps, these content areas could be separated in asTTle V3. The asTTle Mathematics separation of number knowledge and operations and geometric knowledge and operations could also be replicated in future asTTle Pāngarau developments provided sufficient items were available to sustain such fine-grained assessment of Pāngarau learning.

A cursory review of early Māori literature indicates that the quantitative nature of number was not greatly important, it more often being formulaic (such as in the expression *hokowhitu* ‘hoko- a prefix used to signify twenty times the subjoined numeral, *whitu* ‘seven’, therefore *hokowhitu* ‘120’, which can also be used when referring to any group of warriors). However, it is suggested that pattern, and its corollaries of balance and equivalence, permeated Māori thought and culture, both social and material – from the reflective gender-determined kinship terms and pronominal classifications to the intricate designs of *kōwhaiwhai* ‘traditional scroll ornamentation’ and *tāniko* ‘ornamented borders of garments or mats’. Thus, unlike asTTle Mathematics where geometry

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follows measurement, the alignment of content order in Pāngarau, where geometry precedes measurement, is a reflection of the preeminence of pattern in traditional Māori culture, including activities we would now consider to be mathematical.

The knowledge versus application or operations distinction used in asTTle mathematics was also considered to be valid for the Pāngarau Curriculum Framework and this is indicated in the second level of headings. In many cases objectives can clearly be classified as more orientated towards either knowledge or application. Some objectives, as they are currently written in Māori, clearly have both knowledge and application or operation(s). Future versions of asTTle will need to consider whether to re-write or create separate versions for some of the objectives so that these distinctions are much more evident. At the same time, implementation of such a fine-grained distinction could be considered when more items are available.

The Pāngarau Curriculum Framework, like the Mathematics Framework, contains achievement objectives derived from the Exemplar Project. These are listed below:

- Make quarter and half turns;
- Know about simple angles including 90° (right angle) and 180° ; 30° , 45° and 60° ;
- Be able to use a protractor to measure angles to the nearest gradation;
- Assign numerical probability values to simple events;
- Use possible outcomes to assign probabilities;
- Accurately describe aspects of the statistical situation represented by a statistical data display drawn by others.

These were considered to be equally valid for pāngarau and successful items were based on these achievement objectives.

One content area, position (*takotoranga*), appears in the content area measurement (*inenga*), rather than geometry (*āhuahanga*), as per the Curriculum. Clearly, position has components in both measurement and geometry, yet we accept the argument Ell (2001) put forth for position being a mathematical way of describing shape and its properties. Thus, position has been moved to measurement as the majority of asTTle mathematics advisors agree that this is its more logical content area.

The Pāngarau Curriculum Framework

Table 1 of the Pāngarau Curriculum Framework and Map uses terms currently preferred by the author. Table 2 follows the official curriculum vocabulary prescriptions. asTTle is curriculum based and therefore it was decided that curriculum preferred terms would be versions used within the asTTle application. Furthermore, most of the more recently trained teachers have had a good grounding in the Māori curriculum statements and their implementation. Nevertheless, the conceptual framework introduced in Table 1 has been adopted in terms of test creation and performance reporting within the asTTle application.

The framework and map detailed in this report has been revised in the light of feedback from external review and comments from pāngarau teachers, especially commenting that the vocabulary used in the Pāngarau Curriculum Framework should reflect the Pāngarau Curriculum. In addition to this, the statements used in the asTTle software are given in full sentences in the pages following the Framework. This is to clarify the short forms of Māori sentences used in the framework. The vocabulary used in both versions of the Framework and their English equivalents are listed in Appendix 2 by English version alphabetical order.

Full Sentence Versions of Achievement Objectives in the Pāngarau Curriculum

Tau & Taurangi

Mātauranga Tau

Tau oti

Ka pānui, ka whakamārama, ka whakaraupapa i ngā tau oti.

Ka whakamārama i ngā tau tōraro.

Ka whakamārama, ka tātari i ngā pū tau oti.

Hautau, Ōrau, Tau-ā-ira

Ka whakamārama i te tikanga o ngā mati whaiira e toru.

Ka whakaraupapa i ngā mati whaiira e toru.

Paheko Tau

Tau oti

Ka mahara, ka whakamahi i ngā tikanga (meka) tāpirihanga, tangohanga, wehewehe, me te whakarau (whakarea).

Ka tāpiri ka tango, ka wehewehe, ka whakarau (whakarea) i ngā tau oti.

Ka whakamahi, ka whakaoti i ngā whārite rāangi māmā.

Ka whakamahi, ka tuhi, ka whakamāori i ngā kauwhata.

Ka tuhi, ka whakaoti i ngā rapanga paki tau oti, i ngā rapanga whakarite tau oti ki ngā momo paheko e hāngai ana.

Whakatau tata

Ka whakatau tata, ka whakamātau i aua whakatau.

Hautau, Ōrau, Tau-ā-ira

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Ka whakamahi, ka kimi, ka whakaatu i ngā hautau rānei, i ngā ōrau rānei, i ngā tau-ā-ira rānei mai i te tau oti.

Ka tito, ka whakaoti i ngā rapanga whai tau-ā-ira rānei, whai hautau rānei.

Ka kimi, ka hurihuri i ngā hautau ōrite rānei, i ngā tau-ā-ira ōrite rānei, i ngā ōrau ōrite rānei ki ngā momo paheko.

Tautuhi & Raupapa Taurangi

Tauira Raupapa, Tauira Tāruarua

Ka kimi, ka whakaroa, ka whakamārama, ka tito ture mō ngā tauira tau, mō ngā tauira āhua.

Ka whakamahi ture hei matapae i ngā tauira.

Tikanga Taurangi

Ka whakaoti i ngā whārite māmā.

Ka mōhio ki te raupapa paheko.

Āhuahanga

Mātauranga/Paheko Āhuahanga

Āhua ahu-2, āhua ahu-3

Ka tautuhi, ka kōrero i ngā āhuatanga o ngā āhua ahu-2 o ngā āhua ahu-3.

Ka tātai i te paenga i te horahanga i te kītanga.

Ka kōrero i ngā momo hangarite.

Koki

Ka mōhio ki te huringa-ā-karaka ki te huringa kōaro, ki te huringa kotahi hau hauwhā, ki te huringa kotahi haurua.

Ka mōhio ki ngā koki (90°, 180°, 30°, 45°, 60°).

Hangarite & Panoni

Ka kōrero, ka tuhi, ka hanga i ngā tauira āhuahanga e mau ana i te whakaatatanga, i te nekehanga, i te huringa.

Ka whakanui, ka whakaiti i te āhua ahu-2.

Koki

Ka whakamahi i ngā huringa.

Ka whakamahi i te ine koki hei ine i ngā koki.

Hanga & Tuhi

Ka tautuhi, ka kōrero, ka hanga, ka whakatauiria, ka tuhi i ngā āhua ahu-2, i ngā ahu-3.

Ka tuhi raumata hei hanga i ngā matarau māmā.

Inenga

Inenga

Ngahuru

Ka ineine, ka whakatau tata i te ine roa, i te papatipu, i te rōrahi, i te horahanga, i te kītanga, i te mahana.

Ka ineine, ka mōhio ki te inenga āwhata ki te tauwhata tata rawa.

Wā

Ka whai, ka huri i te wā ringarua, i te wāmati.

Ka tātai wā ki te karaka 12 ngā hāora, ki te karaka e 24 ngā hāora.

Ka mōhio ki ngā inenga wā.

Ka whai, ka whakamāori, ka hanga i ngā kōrero āwhata, i ngā wātaka, i ngā tūtohi wā.

Takotoranga

Ka kōrero ka whakamāori, ka tuhi, ka tautuhi i te takotoranga ki te ahunga, ki te tawhiti, ki te mahere āwhata, ki te taunga tukutuku.

Tauanga

Tūponotanga

Whakamātau

Ka whakariterite, ka whakaraupapa, ka kohikohi i ngā raraunga whaihua.
Ka matapae i tētahi pāpono ki te tūponotanga.

Whakatauirā

Ka kimi huarahi nahanaha hei tatau pāpono. Ka whakamahi hoahoa
hei whakaatu pāpono.
Ka whakamahi i te hoahoa rākau hei whakaatu i te pāpono.
Ka whakarite ka matapae i ngā tūponotanga i ngā auau o ngā pāpono.
Ka whakatau tata i ngā auau o ngā pāpono, ka tuhi ai ki te āwhata.

Tauanga

Hōpara

Ka whakarite hōpara. Ka kimi raraunga.
Ka kohikohi, ka whakaari raraunga.
Ka kōwhiri, ka whakaari i te raraunga.
Ka kōwhiri, ka hanga whakaaturanga raraunga.
Ka tuhi, ka whakamahi i ngā āwhata māmā.

Whakamāori

Ka kōrero, ka tuhi pūrongo mō ngā āhuatanga kōhure o ngā whakaari raraunga.
Ka whakarite, ka whakawā i ngā whakatau mō te whakamāoritanga o ngā
raraunga.

Table 1. Pāngarau Curriculum Framework, First Version (levels 2-4)

| Tau & Taurira | | | Toi Āhua | | Inenga | Tātaritari | |
|--|---|--|--|--|---|---|--|
| Mātauranga Tau | Paheko Tau | Taurira Tau | Mātauranga Āhua | Hanga Āhua | Inenga | Tūponopono | Tātaritari |
| <p><u>Tau oti</u></p> <ul style="list-style-type: none"> Whai, whakamārama, Whakaraupapa tau oti. Whakamārama tau tōraro Whakamārama, tātai i ngā pū tau oti <p><u>Tau wāhi, ārautanga, tau-ā-ira</u></p> <ul style="list-style-type: none"> Whakamārama tikanga mati & Whakaraupapa tau e toru ngā mati-ā-ira | <p><u>Tau oti</u></p> <ul style="list-style-type: none"> Mahara, whakamahi tikanga tāpiripiri, tangotango, whakarau Tāpiri, tangotango, whakarau, wehewehe tau oti Whakamahi, whakaoti whakaritenga hangatahi Whakamahi, hoahoa, whakamāori kauwhata Tito, whakaoti paki raparapa, rapanga kikokiko mau tau oti e whiri paheko ai <p><u>Whakapae</u></p> <ul style="list-style-type: none"> Whakapae, whakamātau otinga <p><u>Tauwāhi & Tau-ā-ira</u></p> <ul style="list-style-type: none"> Whakahuri wāhanga rahinga hei tauwāhi, tau-ā-ira, ārautanga Whakahurihuri i ngā tauwāhi haurite, tau-ā-ira, ārautanga Tito, whakaoti rapanga whai tauwāhi, tau-ā-ira, ārautanga | <p><u>Taurira hātepetepe, tāruarua</u></p> <ul style="list-style-type: none"> Kimi, whakaroa, kōrero, tito ture mō ngā taurira tau, taurira āhua Whakamahi ture hei matapae ture <p><u>Tikanga tau</u></p> <ul style="list-style-type: none"> Whakaoti whāritenga hangatahi Mōhio ki te raupapa paheko | <p><u>Āhua ahu-2, -3</u></p> <ul style="list-style-type: none"> Tautuhi āhua, ka kōrero ai i ngā āhuatanga ahu-2, -3 Tātai takanga, horahanga, kītanga Kōrero i ngā momo hangarite <p><u>Koki</u></p> <ul style="list-style-type: none"> Mōhio ki ngā huringa-ā-karaka, hurituatanga kia kotahi whātanga, rautanga Mōhio ki ngā koki māori (90°, 180°, 30°, 45°, 60°) | <p><u>Hangarite & Panoni</u></p> <ul style="list-style-type: none"> Kōrero, hoahoa, hanga taurira āhua ki te tāruarua, hurihuri, whakaata Whakarahi, whakaiti āhua ahu-2 <p><u>Koki</u></p> <ul style="list-style-type: none"> Huri-ā-karaka, huritua kia kotahi whātanga, ruatanga Whakamahi tāputu hei ine koki <p><u>Hanga & Hoahoa</u></p> <ul style="list-style-type: none"> Tautuhi, kōrero, hanga, whakatauirā, hoahoa āhua ahu-2, -3 Hoahoa papakahu hei hanga matarau hangatahi | <p><u>Wāhi</u></p> <ul style="list-style-type: none"> Kōrero, whakamāori, tuhi, tautuhi takotoranga ki ngā ahunga, hoahoa ahurite, taunga tukutuku <p><u>Tāmīta</u></p> <ul style="list-style-type: none"> Ineine, whakapae ine roa, taumaha, horahanga, kītanga, kapinga, pākiri Ineine, whai inenga, whatarau ki te tauputu tata rawa <p><u>Wā</u></p> <ul style="list-style-type: none"> Whai, whakawhiwhi i te wā ringarua, matirau Tātai wā ki te karaka 12, 24-hāora Mōhio ki ngā tikanga wā Whai, whakamāori, hanga kōrero, whatarau, wātaka, papatohu wā | <p><u>Whakamātau</u></p> <ul style="list-style-type: none"> Whakariterite, whakaraupapa raraunga Matapae putanga ki te tūponotanga <p><u>Whakatauirā</u></p> <ul style="list-style-type: none"> Kimi haurahi nahanaha hei tatautanga Whakamahi hoahoa mangarau hei kimi putanga Whakapae rauputanga, ka tuhi ai ki te whatarau Whakarite ritenga tau ki te tūponotanga Whakamahi putanga hei tātai tūponotanga | <p><u>Hōpara</u></p> <ul style="list-style-type: none"> Whakarite hōpara Kohikohi raraunga Kōwhiri, hanga whakaaringa raraunga Hoahoa, whakamahi whatarau hangatahi <p><u>Whakamāori</u></p> <ul style="list-style-type: none"> Kōrero, pūrongo i ngā āhuatanga kōhure o ngā whakaaringa raraunga Whakarite, whakawā i ngā whakataui, whakamāoritanga raraunga |

Table 2. Pāngarau Curriculum Framework, Final Version (levels 2-4)

| Tau & Taurangi | | | Āhuahanga | Inenga | Tauanga | | |
|---|---|--|---|--|--|---|--|
| Mātauranga Tau | Paheko Tau | Tautuhi & Raupapa Taurangi | Mātauranga/Paheko Āhuahanga | Inenga | Tūponotanga | Tauanga | |
| <p><u>Tau oti</u></p> <ul style="list-style-type: none"> • Whai, whakamārama, whakaraupapa tau oti • Whakamārama tau oti tōraro • Whakamārama, tātari i ngā pū tau oti <p><u>Hautau, Ōrau, Tau-ā-ira</u></p> <ul style="list-style-type: none"> • Whakamārama tikanga mati & Whakaraupapa tau e toru ngā mati whaiira | <p><u>Tau oti</u></p> <ul style="list-style-type: none"> • Mahara, whakamahi tikanga (meka) tāpiritanga, tangohanga, whakarau • Tāpiri, tango, whakarau, wehewehe tau oti • Whakamahi, whakaoti whārite rārangi • Whakamahi, tuhi, whakamāori kauwhata • Tito, whakaoti rapanga paki, rapanga whakarite mau tau oti e whiri paheko ai <p><u>Whakatauta</u></p> <ul style="list-style-type: none"> • Whakatauta, whakamātau otinga <p><u>Hautau, Ōrau, & Tau-ā-ira</u></p> <ul style="list-style-type: none"> • Ka huri, whakamahi tau oti hei hautau, tau-ā-ira, ōrau • Tito, whakaoti rapanga whai hautau, tau-ā-ira, ōrau • Huri i ngā hautau ōrite, tau-ā-ira, ōrau | <p><u>Tauira -Raupapa, -Tāruarua</u></p> <ul style="list-style-type: none"> • Kimi, whakarua, whakamārama, tito ture mō ngā tauira tau, tauira āhua • Whakamahi ture hei matapae tauira <p><u>Tikanga Taurangi</u></p> <ul style="list-style-type: none"> • Whakaoti whārite māmā • Mōhio ki te raupapa paheko | <p><u>Āhua ahu-2, -3</u></p> <ul style="list-style-type: none"> • Tautuhi āhua, ka kōrero ai i ngā āhuatanga ahu-2, -3 • Tātai paenga, horahanga, kītanga • Kōrero i ngā momo hangarite <p><u>Koki</u></p> <ul style="list-style-type: none"> • Mōhio ki ngā huringa-ā-karaka, huringa kōaro, kia kotahi hauwhā, kotaihi haurua • Mōhio ki ngā koki (90°, 180°, 30°, 45°, 60°) | <p><u>Hangarite & Panoni</u></p> <ul style="list-style-type: none"> • Kōrero, tuhi, hanga tauira āhuahanga ki te nekehanga, huringa, whakaatatanga • Whakarahi, whakaiti āhua ahu-2 <p><u>Koki</u></p> <ul style="list-style-type: none"> • Whakamahi huri • Whakamahi ine koki hei ine koki <p><u>Hanga & Tuhi</u></p> <ul style="list-style-type: none"> • Tautuhi, kōrero, hanga, whakatauiria, tuhi āhua ahu-2, -3 • Tuhi raumata hei hanga matarau māmā | <p><u>Ngahuru</u></p> <ul style="list-style-type: none"> • Ineine, whakatauta tata ine roa papatipu, rōrahi, horahanga, kītanga, mahana • Ineine, mōhio ki te inenga āwhata ki te tauwhata tata rawa <p><u>Wā</u></p> <ul style="list-style-type: none"> • Whai, Huri i te wā ringarua, wāmati • Tātai wā ki te karaka 12 hāora, 24 hāora • Mōhio ki ngā inenga wā • Whai, whakamāori, hanga kōrero āwhata, wātaka, tūtohi wā <p><u>Takotoranga</u></p> <ul style="list-style-type: none"> • Kōrero, whakamāori, tuhi, tautuhi takotoranga ki ngā ahunga, tawhiti, mahere āwhata, taunga tukutuku | <p><u>Whakamātau</u></p> <ul style="list-style-type: none"> • Whakariterite, whakaraupapa, kohikohi raraunga whaihua • Matapae pāpono ki te tūponotanga <p><u>Whakatauiria</u></p> <ul style="list-style-type: none"> • Kimi haurahi nahanaha hei tatau pāpono • Whakamahi hoahoa rākau hei whakaatu pāpono • Whakarite, matapae tūponotanga me ngā auau o ngā pāpono • Whakatauta auau o ngā pāpono, ka tuhi ai ki te āwhata | <p><u>Hōpara</u></p> <ul style="list-style-type: none"> • Whakarite hōpara • Kohikohi raraunga • Kōwhiri, whakaari raraunga • Kōwhiri, hanga whakaaturanga raraunga • Tuhi, whakamahi āwhata māmā <p><u>Whakamāori</u></p> <ul style="list-style-type: none"> • Kōrero, pūrongo i ngā āhuatanga kōhure o ngā whakaari raraunga • Whakarite, whakawā i ngā whakatauta mō te whakamāoritanga raraunga |

Characteristics of the Pāngarau Curriculum Map

The Pāngarau Curriculum Map is given in Appendix 1. The map was completed first and used to inform the development of the Pāngarau Curriculum Framework.

The major headings of the map are:

- *tikanga tau* ‘number properties/knowledge’,
- *tātaimai/whakapae* ‘number and algebraic operations/estimate’,
- *ineine tāmita* ‘metric measurement’,
- *pahurenga wā* ‘time’,
- *tauira* ‘pattern’,
- *āhua & wāhi* ‘shape and place’,
- *tūpono* ‘probability’, and
- *tātaritari* ‘statistics’.

Achievement objectives, often re-written in simplified language, appear under the major headings by year level. The arrows indicate a possible progression of achievement objectives (or sometimes a group of achievement objectives) over curriculum levels and which are related. These progressions are not always continuous and sometimes one objective may link to a number of objectives at a higher level or groups of objectives may have some overlap or relationship. Other objectives are given in isolation and not all proceed to higher levels.

Each achievement objective’s curriculum content area origin is indicated by the following codes:

| | | |
|----|------------------|---------------|
| T | <i>Tau</i> | ‘number’ |
| I | <i>Ine</i> | ‘measurement’ |
| A | <i>Āhuahanga</i> | ‘geometry’ |
| TR | <i>Taurangi</i> | ‘algebra’ |
| TT | <i>Tauanga</i> | ‘statistics’ |

The number following the abbreviation indicates taumata ‘level’ and the final number indicates the actual achievement object number as listed in the curriculum, (i.e. (T II–3) indicates the third level 2 number objective). An asterisk indicates an achievement objective derived from another already appearing in the map.

Conclusion

The asTTle pāngarau curriculum framework and map is a Māori language based framework that supports the teaching of pāngarau and provides a strong basis for the development of asTTle pāngarau assessment items and reporting of student achievement. Although not identical to the Pāngarau Curriculum, it is clearly derived from it and takes advantage of professional reflection and research on mathematics education conducted in the last decade. Additional achievement objectives can be readily accommodated, as it is clear that the Pāngarau Curriculum does not cover all activities currently undertaken in pāngarau classrooms. The framework uses pāngarau curriculum vocabulary and can be updated if future developments result in changes or modifications to existing terminology.

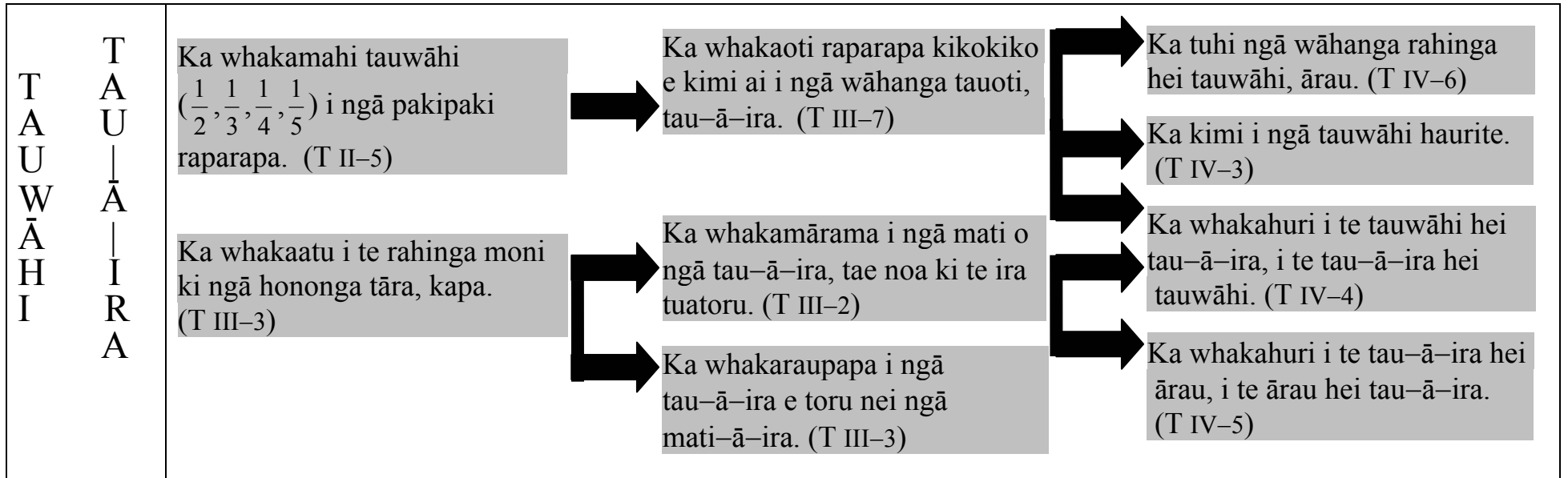
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Appendix 1. Pāngarau Curriculum Map (levels 2-4)

TIKANGA TAU

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|----------------------------|--|---|---|
| T A U O T I | Ka whai i ngā tauoti mati 2, 3. (T II-1) | Ka whai i ngā tauoti mati katoa. (T III-1*) | |
| | Ka whakamārama i ngā mati o ngā tauoti mati 2, 3. (T II-2) | Ka whakamārama i ngā mati tauoti katoa. (T III-1) | |
| | Ka whakaraupapa i ngā tauoti e toru (T II-3) | Ka whakaraupapa i ngā tauoti. (T III-3*) | |
| | | | Ka whakamārama i ngā tau tōraro. (T IV-1) |
| | | | Ka whakamārama, ka tātai i ngā pūtanga tauoti. (T IV-2) |



TĀTAITAI / WHAKAPAE I

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|----------------------------|--|---|--|
| P A H E K O | Ka whakaoti-ā-hinengaro i ngā mahi tāpiripiri, tangotango (T II-8) | | |
| | Ka mahara ki ngā tikanga tāpiripiri, tangotango. (T II-7) | | |
| | Ka whakaatu i te mōhio ki ngā tikanga whakarau. (T II-9) | Ka mahara ki ngā tikanga Whakarau. (T III-5) | |
| | Ka mōhio ki te tāpiripiri, tangotango, whakarau, wehewehe tauoti. (T II-10*) | Ka tāpiripiri, tangotango, whakarau, wehewehe tauoti, tau-ā-ira. (T III-6*) | Ka whakamārama i ngā hātepe tāpiripiri, tangotango, whakarau tika. (T IV-10) |
| | Ka whakarite toenga moni. (I II-2) | | Ka whakaatu i te mōhio ki te raupapa paheko. (T IV-11) |
| | Ka whakamahi i ngā tohu tātai: =, <, >. (TR II-3) | Ka whakaoti, whāritenga pēnei i te $r + 15 = 39$. (TR III-5) | Ka whakaoti whāritenga pēnei i te $5r + 3 = 23$. (TR IV-5) |

TĀTAITAI / WHAKAPAE II

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|---|---|---|---|
| W H A K A R A P A O T I A | Ka tuhi, ka whakaoti rapanga whakarite (T II-4) | | |
| | Ka whakapae, ka whakamātau otinga. (T II-6) | Ka whakapae, ka whakamātau otinga (T III-4) | Ka whakapae, ka whakamātau i ngā otinga. (T IV-7) |
| | Ka tito ka whakaoti paki raparapa, tauoti e mau ai <ul style="list-style-type: none"> • te paheko kotahi; (T II-10) • te paheko hei whiri: (T II-1) • ngā tauwāhi: $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$. (T II-5) | Ka tito, ka whakaoti rapanga whai tauoti, tau-ā-ira e whiri ai i (t)ētahi o ngā paheko. (T III-6) | Ka tito, ka whakaoti raparapa wha i whakarauhanga, wehenga tau-ā-ira. (T IV-8) |
| | | Ka whakaoti rapanga kikokiko e kimi ai i ngā wāhanga tauoti, tau-ā-ira. (T III-7) | Ka kimi i te tauwāhi, ārau rahinga. (T IV-9) |
| | | Ka tautuhi i te ture mō te whakaoti raparapa kikokiko (TR III-3) | Ka kimi, ka parahau tauira kupu e whakatau ana i te āhuatanga mahi noa. (TR IV-4) |

INEINE TĀMITA

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|--|--|---|---|
| M A I N E I N E O A | Ka whai mahi ineine, me ngā inenga tāmita o te: • roa, • taumaha, • rahi (I II-1) | Ka whakatau i te mōhio ki ngā inenga matua: • roa • taumaha • horahanga • kītanga • pākiri (I III-1) | Ka whai mahi ineine e uru ai te whai whatarau ki te tauputu tata rawa. (T IV-1) |
| | | Ka whai mahi ineine, me ngā inenga, whatarau huhua (I III-2) | |

PAHURENGA WĀ

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|---|--|---|--|
| I N E I N E I W Ā | Ka whai i te wā, ka mōhio ki ngā inenga wā: • ringaringa • mati. (I II-4) | Ka whakawhitiwhiti i te wā ringaringa me te wā matirau. (I III-4) | Ka mahi tātainga wā, me te karaka 24-hāora. (I IV-5) |
| | Ka whai i te wā, ka mōhio ki ngā inenga wā – meneti, hāora, rā wiki, marama, tau. (I II-4) | Ka whai, ka whakamāori i ngā kōrero mau wā. (I III-3) | Ka whai, ka hanga whatarau, wātaka, papatohu. (I IV-3) |

TAUIRA

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|--|---|---|---|
| <p>T A U I R A</p> | <p>Ka whakaroa tauira raupapa, ka whakarite ture ai. (TR II-1)</p> <p>Ka whakamahi kauwhata hei whakaatu i ngā pānga. (TR II-2)</p> | <p>Ka kōrero i ngā tauira tau, mokowā hātepe. (TR III-1)</p> <p>Ka tito ka whakamahi ture e puta ai te tauira raupapa. (TR III-2)</p> <p>Ka whakamahi kauwhata hei whakaatu i ngā pānga tau, pānga noa. (TR III-4)</p> | <p>Ka kimi ture hei kōrero i ngā haunga hātepe tau. (TR IV-1)</p> <p>Ka whakamahi ture hei matapae. (TR IV-2)</p> <p>Ka tuhi, ka whakamāori i ngā kauwhata whakaatu āhuatanga māori. (TR IV-3)</p> |
| <p>P H A N N O G N A R I T E</p> | <p>Ka huri-ā-karaka, ka huritua. (A II-4)</p> <p>Ka hanga, ka whakaahua i ngā tauira:</p> <ul style="list-style-type: none"> • āhua tāruarua • hangarite hurihuri • whakataata. (A II-3) | <p>Ka hoahoa, ka hanga i te tauira:</p> <ul style="list-style-type: none"> • tāruarua • hurihuri • whakaataata. (A III-7) <p>Ka kōrero i ngā tauira mau:</p> <ul style="list-style-type: none"> • hangarite hurihuri • hangarite whakaata • nekenekehanga. (A III-6) <p>Ka whakarahi ahurite i runga i te tukutuku. (A III-8)</p> | <p>Ka whakauru i ngā tikanga hangarite o te taparau rite. (A IV-6)</p> <p>Ka kōrero i te hangarite whakataata, hurihuri o te āhua taonga. (A IV-7)</p> <p>Ka whakarahi, ka whakaiti āhua ahu-2, ka tautuhi ai i ngā āhuatanga pūmau. (A IV-8)</p> |

ĀHUA & WĀHI

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|------------------|--|---|---|
| Ā H U A | <p>Ka hanga, ka tautuhi, ka kōrero i ngā āhua māori:</p> <ul style="list-style-type: none"> • ki tōna reo • ki te reo toi āhua. (A II-8) | <p>Ka kōrero i ngā mea ahu-2, -3 ki te reo toi āhua. (A III-1)</p> <p>Ka whakatauirā, kōrero i ngā mea ahu-3 i whakaahuatia. (A III-3)</p> <p>Ka whakaahua o ngā mea ahu-3 ngāwari. (A III-4)</p> <p>Ka hoahoa, ka hanga pouaka e ai ki ngā tohutohu. (A III-2)</p> | <p>Ka tuhi tapatoru, porohita ki ngā taputapu tika. (A IV-1)</p> <p>Ka tātai (ki ngā inenga roanga):</p> <ul style="list-style-type: none"> • hāngai, tapatoru • horahanga tapawhā hāngai • kītanga porowhā. (I IV-2) <p>Ka hanga tauira papatupu ki ngā hoahoa o runga, mua, muri, ngā taha. (A IV-3)</p> <p>Ka tuhi hoahoa o ngā taonga I hanga ki te porowhā. (A IV-4)</p> <p>Ka hoahoa papakahu hei hanga matarau ngāwari e ai ki ngā tohutohu. (A IV-2)</p> |
| W Ā H I | <p>Ka kōrero, ka whakamāori i te takotoranga. (A II-2)</p> | <p>Ka whakaahua, whakamāori i ngā hoahoa ahurite. (A III-5)</p> | <p>Ka tautuhi takotoranga ki ngā ahunga, taunga tukutuku. (A IV-5)</p> |

TŪPONOPONO

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|----------------------------|---|---|--|
| T Ū P O N O | <p>Ka whakariterite putanga, ka whakaraupapa ki te tūponotanga. (TT II-4)</p> | <p>Ka kimi huarahi nahanaha hei tatau putanga. (TT III-5)</p> <p>Ka matapae putanga ki tāna i kitekite ai. (TT III-6)</p> | <p>Ka whakamahi hoahoa mangarau hei kimi putanga. (TT IV-9)</p> <p>Ka whakapae i te rauputanga, ka tuhi ai ki runga i te whatarau. (TT IV-8)</p> |

TĀTARITARI I

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|--|---|---|--|
| <p>H Ō P A R A</p> | <p>Ka kohikohi, ka whakaatu raraunga āhua, tauoti ki te</p> <ul style="list-style-type: none"> • kauwhata āhua • papa tatau • kauwhata poupou. (TT II-1) | <p>Ka kohikohi, ka whakaatu raraunga tau mowaho ki te:</p> <ul style="list-style-type: none"> • kauwhata rau-tō • kauwhata ira • kauwhata tāhei. (TT III-2) <p>Ka whakarite hōpara tāpaetanga kōrero. (TT III-1)</p> | <p>Ka kōwhiri, ka hanga whakaaringa raraunga hei whakaatu āhuatanga tāpua:</p> <ul style="list-style-type: none"> • papatau • kauwhata poupou • kauwhata pouhere. (TT IV-2) <p>Ka kohikohi, ka whakaatu raraunga raupapa houanga. (TT IV-4)</p> <p>Ka hoahoa, ka whakamahi whatarau ngāwari hei ine raraunga kounga kounga. (I IV-4)</p> <p>Ka whakamahi ture hei matapae (TR IV-2)</p> <p>Ka kohikohi raraunga hāngaingai. (TT IV-2)</p> |

TĀTARITARI II

| Kaupapa | Taumata 2 | Taumata 3 | Taumata 4 |
|--|--|--|--|
| <p>W H A K A M Ā O R I</p> | <p>Ka kōrero atu i āna ake whakaaringa raraunga. (TT II-2)</p> <p>Ka kōrero atu i te hapanga o te whakaaringa raraunga a tētahi atu. (TT II-3)</p> | <p>Ka whakamārama i ngā āhuatanga kōhure</p> <ul style="list-style-type: none"> • mowaho • rāpoi <p>i āna, i a ētahi atu whakaaringa raraunga. (TT III-3)</p> <p>Ka whakaputa whakaaro whitake mō te tāpaetanga kōrero. (TT III-4)</p> | <p>Ka whakamārama i ngā āhuatanga kōhure o te whakaaringa raraunga:</p> <ul style="list-style-type: none"> • mowaho • rāpoi • hanga tuaringa. (TT IV-5) <p>Ka whakawā i ngā whakamāramatanga a ētahi atu. (TT IV-6)</p> <p>Ka tāpae whakaaro i ngā pānga mahi e hāngai ai ki ngā tukunga iho. (TT IV-7)</p> |

Appendix 2. Pāngarau Vocabulary

| Mathematics Term | Curriculum Equivalent | First Version Terminology |
|-------------------------|--------------------------|---------------------------|
| 2D & 3D shape | <i>āhua ahu-2, -3</i> | |
| algebra | <i>taurangi</i> | |
| analogue time | <i>wā ringarua</i> | |
| angle | <i>koki</i> | |
| area | <i>horahanga</i> | |
| bearings | <i>taunga</i> | |
| capacity | <i>kītanga</i> | <i>kapinga</i> |
| construct | <i>hanga/waihanga</i> | |
| decimal | <i>tau-ā-ira</i> | |
| decimal place | <i>mati whaiira</i> | <i>mati-ā-ira</i> |
| digit | <i>mati</i> | |
| digital time | <i>wāmati</i> | <i>wā matirau</i> |
| direction | <i>ahunga</i> | |
| display (n.) | <i>whakaari</i> | <i>whakaaringa</i> |
| distance | <i>tawhiti</i> | |
| distinctive | <i>kōhure</i> | |
| draw | <i>tuhi</i> | <i>hoahoa</i> |
| equivalent | <i>taurite</i> | <i>haurite</i> |
| estimate | <i>whakatau tata</i> | <i>whakapae</i> |
| evaluate (not assess) | <i>tātari</i> | <i>tātai</i> |
| event | <i>pāpono</i> | <i>putanga</i> |
| fraction | <i>hautau/hautanga</i> | <i>tau wāhi</i> |
| frequency of appearance | | <i>rauputanga</i> |
| geometry | <i>āhuahanga</i> | <i>toi āhua</i> |
| gradation | <i>tauputu</i> | |
| grid | <i>tukutuku</i> | |
| identify | <i>tautuhi</i> | |
| interpret | <i>whakamāori</i> | |
| investigate | <i>whiriwhiri/hōpara</i> | <i>hōpara</i> |
| length | <i>roa (-nga)</i> | |
| linear equation | <i>whārite rārangi</i> | <i>whāritenga rārangi</i> |
| mass | <i>papatipu</i> | <i>taumaha</i> |
| measurement | <i>inenga</i> | <i>ineine</i> |
| metric | <i>ngahuru</i> | <i>tāmita</i> |
| model (v.) | <i>whakatauiria</i> | |
| net (geometry) | <i>raumata</i> | <i>papakahu</i> |
| number | <i>tau</i> | <i>tau/nama</i> |
| outcome | <i>hua</i> | <i>putanga</i> |
| operate (with) | <i>whawhe</i> | <i>hanga</i> |
| operation | <i>paheko</i> | |
| order | <i>raupapa</i> | |
| pattern | <i>tauiria</i> | <i>hoahoa</i> |
| percent | <i>ōrau</i> | <i>ārautanga</i> |
| perimeter | <i>paenga</i> | <i>takanga</i> |
| power (of a number) | <i>pū</i> | |
| position | <i>takotoranga</i> | <i>wāhi</i> |
| practical problems | <i>rapanga whārite</i> | <i>rapanga kikokiko</i> |

| | | |
|---------------------|-------------------------|-----------------------------|
| predict | <i>matapae</i> | |
| probability | <i>tūponotanga</i> | <i>tūponopono</i> |
| problem | <i>rapanga</i> | |
| problem solving | <i>whakaoti rapanga</i> | |
| properties | <i>āhuatanga</i> | <i>āhuatanga/tikanga</i> |
| protractor | <i>ine koki</i> | <i>tāputu</i> |
| repeating | <i>tāruarua</i> | |
| scale | <i>āwhata</i> | <i>whatarau</i> |
| scale map | <i>mahere āwhata</i> | <i>hoahoa ahurite</i> |
| sequence/sequential | <i>raupapa</i> | <i>hātepetepe</i> |
| simple equation | <i>whārite māmā</i> | <i>whāritenga hangatahi</i> |
| solve | <i>whakaoti</i> | |
| spatial pattern | <i>tauirā mokowā</i> | <i>tauirā āhua</i> |
| statistics | <i>tauanga</i> | <i>tātaritari</i> |
| symmetry | <i>hangarite</i> | |
| temperature | <i>mahana</i> | <i>pākiri</i> |
| time | <i>wā</i> | |
| transformation | <i>panoni</i> | |
| translation (geo.) | <i>nekehanga</i> | |
| trial (v.) | <i>whakamātau</i> | |
| tree diagram | <i>hoahoa rākau</i> | <i>mangarau</i> |
| understand | <i>orotau/arotau</i> | <i>mārama (ki)</i> |
| use | <i>whakamahi</i> | |
| volume | <i>rōrahi</i> | |
| whole number | <i>tau oti</i> | <i>tauoti</i> |