

Developing a Pūtaiao resource: *Ngā Hekaheka o Aotearoa*

Georgina Tuari Stewart* and Peter Buchanan

Te Kura Mātauranga – School of Education, Auckland University of Technology, and Manaaki Whenua–Landcare Research, Private Bag 92170, Auckland 1142

Abstracts

He aha ngā āhuatanga e eke ai tētahi rauemi Pūtaiao mō te rūma ako? Ka whaiwhakaaro tēnei tuhinga ki tēnei urupounamu mā te hoki atu ki te tukanga whakawhanaketanga i Ngā Hekaheka o Aotearoa, koia tētahi rauemi i whakairohia ai hei tautoko i te whakaako me te ako i roto mai i ngā kura kaupapa Māori mō te hekaheka o Aotearoa Niu Tīreni. I toko mai te hiahia ki tēnei tuhinga i ngā wheako o te kaituhi tuatahi e whakaako ana i te pūtaiao, e whakawhanake ana hoki i ngā rauemi Pūtaiao mō te hiata te roa. Ko te whāinga ia ka puta mai he ārahitanga whaitake mō te whakawhanake tonu i ngā rauemi ā-ruma ako mō te Pūtaiao me ērā anō wānanga kaupapa Māori hei ngā rā ki tua.

What are the characteristics of a successful Pūtaiao classroom resource? This article considers this question by reflecting on the process of developing Ngā Hekaheka o Aotearoa, a resource designed to support teaching and learning in Māori-medium schools about the fungi of Aotearoa-New Zealand. The motivation for this article originates in the first author's decades of experience teaching Pūtaiao and developing Pūtaiao resources. The aim is to provide useful guidance for the development of future classroom resources for Pūtaiao and other Māori-medium learning areas.

Keywords: Hekaheka (fungus), Kura (Māori-medium school), Pūtaiao (Science), Te reo Māori (the Māori language)

Introduction

Primary school science remains an area of intense concern for education researchers, given its foundational role in the education of future scientists and science-literate citizens, and since primary teachers often lack confidence in teaching science (Buntting et al. 2017; Stewart & Buntting 2015). In today's primary schools, science can easily be buried under an ever-growing pile of expectations placed on teachers.

Correspondence: georgina.stewart@aut.ac.nz

Difficult as it is for English-medium primary schools to adequately teach the science curriculum, the situation for Pūtaiao, which is the equivalent of the Science learning area in the curriculum for Māori-medium schools (kura) is more like a 'crisis' (Stewart 2017).

A complex set of intersecting reasons impede the implementation of the Pūtaiao curriculum, over and above the difficulties for primary science education in general, including: the philosophical conflicts between science and Māori knowledge (Stewart 2019); the ongoing residual effects of historical misuse of science to justify racist attitudes by Pākehā towards Māori people and culture; the abyss between scientific genres of English and te reo Māori; the widespread lack of engagement of Māori students in science education, impacting on those cohorts of people who are today's teachers in kura; and a severe lack of classroom resources for teaching and learning Pūtaiao (Stewart 2005, 2007, 2010). The focus of this article is on the last of these factors: the acute need for high-quality materials fit for the purpose of teaching and learning the Pūtaiao curriculum in Māori-medium classrooms.

There is only a very limited financial and human resource available for producing Pūtaiao classroom materials. It is therefore essential to the interests of Māori-medium students and their teachers that this limited resource is used well, based on sound understandings of the divergent demands involved. The dominant approach has been to send a finished English-medium resource to a translator, who may have no background in classroom teaching, the development of the Pūtaiao curriculum, or the accompanying Pūtaiao lexicon. When an already-published English-language story, de-



Georgina Stewart is Associate Professor at Te Kura Mātauranga – School of Education, Auckland University of Technology, and is from the Ngāpuhi, Ngāti Kahu and Ngāti Maru tribes. Dr Stewart graduated with BSc and then MSc (Hons) in Chemistry at Auckland University, then went on to obtain a teaching diploma and later obtained her doctorate in Education at the University of Waikato. Her research interests build on her background as a Māori teacher of science, mathematics and Te Reo Māori in English-medium and Māori-medium secondary schools in Auckland and Whangarei.

Peter Buchanan works for Manaaki Whenua–Landcare Research as a Science Team Leader studying the native and introduced plants, insects, other invertebrates, fungi and bacteria of New Zealand. His particular research interests are the biodiversity, conservation and ecology of New Zealand fungi, especially those causing wood decay and diseases of native plants. He has also contributed to research on the potential of fungi for medicinal use.



signed to appeal to children by being embedded in a 'typical' everyday context, is translated into Māori, the connection to science is easily obscured. The resulting Māori text risks becoming almost meaningless, and such texts are invariably of limited educational, scientific or cultural value/validity. Class sets of such resources – usually consisting of several short, illustrated stories, collected together in student booklets, or school journals – are sent out to every kura in the country, where they end up sitting on shelves, seldom if ever to be opened. The government counts the cost of producing such resources as demonstrating their commitment to the retention and revitalisation of te reo Māori, and those involved in producing the resources benefit by being paid for their work, but the intended end-users receive no help, and Pūtaiao teaching and learning continues to stall.

Pūtaiao education is inherently complex and (largely due to the above effects) still embryonic. Cognisant of these limitations and the position of Pūtaiao in relation to science education in general, this article considers what is involved in developing a successful Pūtaiao classroom resource by narrating the story of one example: the award-winning book *Ngā Hekaheka o Aotearoa* (Buchanan et al. 2017; Copy-right Licensing New Zealand 2018). Before turning to this story, however, some methodological remarks are in order.

About the approach taken to writing this article

This article is unusual in the following three senses: firstly, to write an article about developing a classroom resource challenges dominant ideas of what counts as research in science education. The above paragraphs, however, explain the rationale underpinning this work; the apparently superficial focus provides an opportunity to explore serious educational issues concerning the resourcing of Pūtaiao, a discussion that is also relevant to other subject areas of Māori-medium education. Secondly, this article utilises self-study methods (Lassonde et al. 2009) in being written by the authors of the resource in question, and drawing on the first author's background in Pūtaiao education. Like other auto-methods in educational research, self-study prefers the validity of concrete examples over the quest for scientific objectivity, recognising the socially constructed nature of education practice. Thirdly, each author's voice is visible and separate in the section that follows. This dialogical element is a methodological device for keeping in play the productive tension of different perspectives on knowledge questions, which are evoked by writing a science classroom text in te reo Māori. Accordingly, the first-person voice is used to narrate the book's story, with sections attributed by name to each author.

Having set the scene for the article and commented on its approach, the main section below presents the story of how the resource was developed, narrated mainly in the voice of the first author (Georgina). This story provides a context for considering key practical and theoretical questions that arise in Māori-medium education resource development projects. The last sub-section switches voice to present a response and commentary from the second author (Peter). The conclusion summarises the key points as useful guidance for future resource development projects

A narrative: developing *Ngā Hekaheka o Aotearoa*

Georgina

In August 2016 I received an email from Peter setting up an initial meeting, at which he explained that he had been funded for a six-month project to produce a Pūtaiao classroom textbook written in te reo Māori about the fungi of Aotearoa-New Zealand. Peter expressed his wish to restore to Māori children the traditional Māori knowledge about fungi, which he had collated over the course of his career as a research scientist (mycologist) specialising in these indigenous species. While interested in being involved, I immediately told Peter my past experience suggested six months would be insufficient time to produce the finished resource. I was mindful of the risk of promising more than we could deliver, having once been contracted to write for a large Pūtaiao digital resource development project, very ambitious in scope and technology, but ultimately only partially completed, despite consuming a large budget. In my experience of teaching in kura, even today, books can be more dependable and therefore more valuable classroom teaching tools than computers.

Peter explained that he conceptualised the project as consisting mainly of translating into Māori a chapter on Māori knowledge of fungi, previously published in a science monograph on New Zealand fungi (Fuller et al. 2004). He had therefore already involved expert translator Hēni Jacob, which was fortuitous, since no other translator has more experience than Hēni with te reo Pūtaiao (the language of Pūtaiao), and she and I had worked together before on various Pūtaiao projects over the years. Peter is a senior scientist and expert science writer, but at the beginning of the project he had no experience of writing for the primary classroom, and lacked knowledge about teaching the material to non-scientists and children, or how teaching considerations affect how the material could be presented.

I helped Peter render his scientific knowledge of indigenous fungi into simpler terms suitable for a Māori-medium classroom book. I worked on the English text with Peter before it was sent to Hēni, and worked on the Māori text Hēni sent back. I wrote the classroom activities and teacher guide material, arranged for the draft book to be trialled, and facilitated the launch event. Since we all worked on the text, in different but overlapping roles, the three of us agreed that we would all be named as co-authors of the book.

We decided to produce the book in two versions, one for students and the other for teachers. The student booklet is smaller and in te reo Māori only. This booklet was printed in numbers sufficient for sets of 30 to be provided free of charge to every kura in the country. The teacher booklet is slightly larger; it includes all the material in the student booklet, with full translations into English. It also includes teacher guide material and copy masters for the classroom activities. This version of the book was printed in smaller numbers, and a few were sent out with each set of student booklets. A pdf version of the teacher book is available at the publisher's website: www.huia.co.nz/huia-services/resources-for-teachers/nga-hekaheka-o-aotearoa. The whole resource is also available on the Science Learning Hub: <https://www.sciencelearn.org.nz/images/3711-nga-heka-heka-o-aotearoa>.

In the months following that initial meeting, as our drafts began to take shape, Peter negotiated for more time and funding to complete the project, keeping the funders updated on progress. In the end, it took about 12 months to get to first full-draft stage, and the book launch was held in early December 2017, i.e. 17 months after my first meeting with Peter, and as the copies were in the process of being distributed to kura around the country.

Knowledge content

Our early discussions mainly concerned exactly what content would be included, and in what form. I was aware there was little or nothing in the way of Pūtaiao resources on fungi. Peter's enthusiasm for fungi was infectious, and the information about traditional Māori uses was fascinating. We decided the best way to organise the material was to write the text in two main sections: the first section would give an overview of introductory science relating to fungi, and the second section would be about the traditional Māori knowledge and uses of fungi. Peter and I developed an efficient way to work: we wrote comments in tracked changes on each other's electronic drafts exchanged by email, and mostly used the telephone for discussions and decisions. We never met in person with Hēni, but email proved efficient for communicating between the three of us.

I edited Peter's drafts for the first section, to level the material and break it up into manageable sub-sections. For the second section, I also ordered the material according to Māori perspectives, for example, promoting the tapu (sacred) and culturally significant uses of fungi for tāmoko (tattooing) and carrying fire. That Māori would see such sequencing decisions as significant is related to the gap or 'hyphen' between Māori and Pākehā worldviews (Jones & Jenkins 2008).

Voice

As agreed, after our initial meetings, Peter sent me the first draft piece of text for the introduction section of the book. Peter's first draft was written in the typical anthropological style: 'Early Māori uses of fungi...' The phone rings. "I wouldn't refer to Māori uses of fungi like that." "How would you refer to them, then?" "Probably as 'our tūpuna (ancestors) ...' or something like that."

This kind of negotiation over the positioning of the text was the most obvious clash of 'voices' wherein what Peter the scientist thought of as 'normal' was jarring in the context of a Māori education project. Peter never used that kind of term again: he learned quickly and was always appreciative of the opportunity to learn about Māori perspectives.

A more subtle disjunction of perspective came up in discussing the section on the species pukurau (puff ball). Peter remarked "Waipukurau is the only Māori placename that includes a fungus name" to which I replied that such names are not 'Māori placenames' in a Māori-centred sense. Waipukurau is the only fungus placename that has been appropriated into the standardised set of placenames in use today. So we should say that Waipukurau is the only placename in English that includes a Māori fungus name.

Bringing it all together

Everything continued to fall into place as Peter contracted Huia Publishers to produce the book. A graphic design based on fungi, previously created for Manaaki Whenua-Landcare Research, was used to anchor the booklet design. I looked for a suitable illustration for the section on the use of fungi in tāmoko, and quickly decided on a famous Lindauer painting held by the Auckland City Art Gallery. We obtained permission to use the image, which visually enriches and adds mana (cultural power) to the book. It is important not to underestimate the work required to finalise the draft, which Peter mostly shouldered. Hēni and I continued to check and provide feedback on each version, with three-way discussions of tricky points. In this way, the inevitable hundred-and-one wrinkles were slowly but surely ironed out, one at a time.

The contract required the draft book to be trialled, and we discussed how this might happen. Eventually we negotiated for Peter to bring photocopies of the draft book to a Professional Learning and Development meeting for Pūtaiao and Pāngarau teachers, held during school holidays in early October 2017. I introduced Peter and the project to the teachers, and Peter spoke about the book's content. There was a good level of interest and some useful feedback from the group. Later, I followed up with one tumuaki (principal) from the trial group to organise an event for the book launch, which took place in the last few weeks of the 2017 school year. We held a hui (formal gathering) at the kura, at which the book was blessed, then after morning tea break, Peter and I taught the children using slides made from the book's pages, and ran a practical exercise making spore prints from mushrooms. A video about the resource was produced (Manaaki Whenua-Landcare Research 2018).

Different knowledges in the project

Conflicts between different forms of knowledge have already been mentioned above. In early meetings with Peter, we discussed the language medium requirement of the contract, and I pointed out the small percentage of Māori children who attend kura, the project's intended beneficiaries. Based on my past experience and knowledge of the sector, I recommended making the teacher version bilingual. This enlarges the book's potential range of users, and increases the possibility of its content being adequately taught.

In the book launch video, Peter mentions his belief that Māori had 'lost' their knowledge about fungi, saying this knowledge 'didn't seem to have been maintained' and that he had conceived the project as a way to 'reintroduce' this knowledge to Māori through schools (see 0.40 – 1.00 of video footage). Yet the teachers who attended the lesson that day countered this notion, mentioning traditions from their own families, and adding extra details to those recorded in the book. Afterwards I reflected on how Peter's notion about returning 'lost' Māori knowledge to Māori children aligns with dominant myths of national identity in this country. It is widely promulgated and regarded as 'scientific fact' that Māori have lost their traditional knowledge, and Peter naturally reflects that belief. Like other truth-myths held by Pākehā about Māori, it seems designed to subtly reinforce Pākehā feelings of security and superiority. Yet a counter story can often be found to challenge the dominant view.

The scientist's viewpoint

Peter

This project was highly motivating, taking me well outside my comfort zone as a (Western) scientist, and becoming feasible only once Georgina and Hēni came on board. Georgina's leadership of the educational aspects of this project and links to relevant personnel in Māori-medium education were indispensable. I was also indebted to earlier studies by Rebekah Fuller, who used literature and oral interviews to document Māori knowledge and uses of fungi for her MSc thesis, co-supervised by Mere Roberts and me, and published as Fuller et al. (2004). Rebekah's research found that few kaumātua (elder) interviewees recalled ancestral uses of fungi, which led to my motivation to provide students in kura with access to at least a basic consensus of the knowledge recorded by certain early European writers.

I was attracted to first contact Georgina because of her extensive research publication record concerning Pūtaiao, and her progressive role in its development. Hēni's involvement followed her earlier specialist translation of abstracts and popular summaries for scientific papers on invertebrates and fungi written by various colleagues. Other key insights by Georgina included her advice about the age range for the student audience, checking the appropriateness of language and voice for these students, and identifying and writing classroom activities (questions, a crossword, research activities) to assist student learning.

An important language point that arose early in the project concerned the Māori word for fungus, since the concept of Kingdom Fungi (also Kingdom Animals, Kingdom Plants, etc) is a Western science construct, and equivalent terms are not found in the traditional Māori lexicon. Previous publications on fungi by Manaaki Whenua–Landcare Research, on which Hēni had been consulted, had chosen to use 'harore' to mean fungus; hence the title of a series of publications, *The Fungi of New Zealand–Ngā Harore o Aotearoa*. Harore is a traditional Māori name for a well-known indigenous species of edible mushroom, and has become adopted in modern Māori as the standard word for mushrooms used as food. In the intervening period since those earlier publications, however, lexicon development to support the Pūtaiao curriculum had assigned 'harore' more specifically to mean 'mushroom' and adopted the word 'hekaheka' as a generic term for all fungal forms including moulds. Also, since previously published Pūtaiao resources had largely focused on plants and animals, several Māori terms for fungus-specific words needed to be found, such as fruitbody (ropihua) and hyphae/mycelium (torohihi). The prior combined experience of Hēni and Georgina in developing Pūtaiao terms was extremely helpful in relation to these tasks.

Another early lesson for me, alluded to above, was the need to get over my hesitation to embrace Tāne Mahuta as god of the forest, presiding over all forest organisms. Georgina helped me understand that my intention to communicate effectively with Māori-medium students required me to use the appropriate voice for the audience and learning context. Once over that mental hurdle, composition became easier.

Hēni's language expertise ensured the Māori text was clear and of excellent quality. Georgina provided advice on

the formatting of the book and assisted in formulating the glossary. Artist Ann Gale's labelled diagrams were important for helping students grasp the material about fungal life cycle, feeding and reproduction, and contributed to producing a scientifically accurate and visually appealing resource. Huia Publishers were instrumental in turning the draft resource into a published book with high production values. As with many successful outcomes in science, contributions came from a broad team of collaborating experts in various fields.

Next steps? Our hekaheka resource has been widely distributed and welcomed, but is it being effectively used? Future plans include workshops to assist kaiako (teachers) become more confident in using the resource to teach about hekaheka, including cultivation of one or two edible fungi (stop press: these courses began in 2019 through partnering with Ako Pānuku: www.akopanuku.tki.org.nz). Longer term, it is hoped that an understanding of the biology, ecology, and traditional uses of fungi will encourage hapū to consider cultivation of traditional edible fungi as kai (food sources).

Conclusion: learning from the project

To return to the motivating question for this article, the following list summarises 'what worked' in this project to produce a successful Pūtaiao classroom resource with high educational, scientific and cultural values:

- A bounded science topic aligned with the Pūtaiao curriculum, on which existing resources were lacking;
- A topic suited to classroom teaching but not dependent on specific curriculum links, ensuring the resource would not become outdated by future curriculum revisions;
- A topic from the natural world based on a set of indigenous species, about which there is a well-preserved body of traditional Māori knowledge;
- A topic from a scientist's area of specialist expertise and personal interest/passion;
- The 'x-factor' of collegiality and teamwork between the co-authors of the book;
- Contributions from people with a range of complementary skills in science, te reo Māori, teaching practice, art and design, book production, and knowledge of the kura community;
- A clear project concept that was not overwhelmed by complexities of design or technology.

These factors meant the entire resource could fit within a Māori framework. It is written in clear te reo Māori suitable for primary and early secondary classrooms, and incorporating mandated Pūtaiao vocabulary (www.paekupu.co.nz). Science knowledge and traditional Māori knowledge are each accorded equal significance in the book. Intrinsically interesting material, excellent translation into te reo, good illustrations, high production values, and above all a significant quantity and quality of basic science about fungi, combine to mean this resource makes a useful exemplar for developers of future classroom resources to support Māori-medium education.

Acknowledgements

Appreciation and thanks are due to Hēni Jacob for her talents and expertise as a Māori language consultant, which she

generously brought to the project. Furthermore, related to the purpose of this article, it is important to acknowledge the collaborative spirit that developed between the three co-authors; a special interpersonal quality, based in aroha for the aims of the project and trust in each other, which cannot be generated or replaced by standard project management approaches, and from which the resource greatly benefited.

Acknowledgements and thanks to artist Ann Gale for the labelled diagrams in the book; and for the design and production talents of Te Kani Price and colleagues at Huia Publishers. Acknowledgements to Auckland City Art Gallery for permission to use an image of the painting by Gottfried Lindauer, *The moko artist at work*. Acknowledgements to MBIE for financial support from the *Unlocking Curious Minds* contestable fund.

The authors thank everyone who contributed to producing and trialling the resource, with special acknowledgements of the staff and students of Te Kura Kaupapa Māori o Ngā Maungarongo. He mihi nui ki a koutou katoa.

References

- Buchanan, P., Stewart, G., Jacob, H. 2017. Ngā Hekaheka o Aotearoa. Retrieved from <https://www.huia.co.nz/huia-services/resources-for-teachers/nga-hekaheka-o-aotearoa/>
- Bunting, C., Cowie, B., Anderson, D., Bull, A., Caygill, R., Hipkins, R., Khoo, E., Metcalf, M., Moeed, A., Rice, K., Rofe, C., Peter, M., Stewart, G., Zwaag, C.V. 2017. Towards a systems view of science education in New Zealand. *Curriculum Matters* 13: 63–79. doi:<https://doi.org/10.18296/cm.0024>
- Copyright Licensing New Zealand. 2018. Winners announced for the Copyright Licensing Education Awards 2018. Retrieved from <http://www.copyright.co.nz/about/news-and-event/winners-announced-for-the-copyright-licensing-education-awards-2018>
- Fuller, R., Buchanan, P. K., Roberts, M. 2004. Māori Knowledge of Fungi / Mātauranga o Ngā Harore. Pp. 81–118 in: McKenzie, E.H.C. (Ed.) *Introduction to Fungi of New Zealand*. Hong Kong: Fungal Diversity Press.
- Jones, A., Jenkins, K. 2008. Rethinking collaboration: Working the indigene-colonizer hyphen. Pp. 471–486 in: Denzin, N.K., Lincoln, Y.S., Smith, L.T. (Eds) *Handbook of Critical and Indigenous Methodologies*. Los Angeles, CA: Sage.
- Lassonde, C.A., Galman, S., Kosnik, C. (Eds) 2009. *Self-study Research Methodologies for Teacher Educators*. Rotterdam, The Netherlands: Sense Publishers.
- Manaaki Whenua–Landcare Research. 2018. *Ngā Hekaheka o Aotearoa – Fungi of New Zealand* educational booklet released to Māori immersion schools. Retrieved from <https://www.landcareresearch.co.nz/about/news/snippets/nga-hekaheka-o-aotearoa-fungi-of-new-zealand>
- Stewart, G. 2005. Māori in the science curriculum: Developments and possibilities. *Educational Philosophy and Theory* 37(6): 851–870.
- Stewart, G. 2007. Kaupapa Māori science [Unpublished doctoral dissertation]. University of Waikato, Hamilton, New Zealand. Retrieved from <https://hdl.handle.net/10289/2598>
- Stewart, G. 2010. *Good Science? The Growing Gap between Power & Education*. Rotterdam, The Netherlands: Sense.
- Stewart, G. 2017. A Māori crisis in science education? *New Zealand Journal of Teachers' Work* 14(1): 21–39.
- Stewart, G. 2019. Mātauranga and Pūtaiao: the question of 'Māori science'. *New Zealand Science Review* 75(4): 65–68.
- Stewart, G., Bunting, C. 2015. Teachers, curious minds, and science education. *Curriculum Matters* 11(2015): 98–116.