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INVESTIGATING THE IMPACT OF PATHWAYS AWARUA ON WAIKATO TRADES ACADEMY LEARNERS' READING COMPETENCE

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INTRODUCTION

Given recent claims that literacy skills are declining among 15-year-olds in New Zealand (May & Madina, 2023; MoE, 2023), this article shows that at-risk Waikato Trades Academy (WTA) learners' reading competence, measured by the Literacy and Numeracy for Adult Assessment Tool (LNAAT), has plateaued, with entry-level and exit-level reading scores remaining stable for the past seven years (2017–2023). Consistently, regardless of the literacy and numeracy (LN)-embedding strategy, reading progress for the targeted WTA learners has been statistically significant, with large effect sizes recorded for pre-COVID-19, COVID-19 and post-COVID-19 cohorts.

Once individualised LNAAT reading protocols are available, vocational educators and learning advisors are required to select relevant interventions that address learner needs at their level of competence. As an intervention, Pathways Awarua is the resource of choice because its modules are aligned with the LNAAT and the learning progressions (TEC, 2008a, b). This requires that educators and learning advisors have relevant expertise in assisting learners to make this choice of intervention. It should be noted too that, although Pathways Awarua modules were designed for self-directed learning (as occurred in this study), several case studies found that learners benefited from educator mediation in these online sessions, especially where the educator offered immediate performance-enhancing feedback to boost learner engagement (Alkema et al., 2014).

An important aspect to consider here is the level of mediation: are educators and support staff equipped to mediate the interactive online engagement of learners enrolled on Pathways Awarua? Managing cohorts of learners to access these interactive online modules is not enough. Educator and support staff training on how to use prompts, ask questions, give clues, and use extended sequences of interaction is key. For example, the use of implicit, explicit and fading graduated prompts seems indicated in lifting LN outcomes for learners (Fang et al., 2016; Navarro & Mourgues-Codern, 2018) above current levels of performance for the targeted cohort of WTA learners. A significant positive for the sector is the reading support and training available from Ako Aotearoa (Pathways Awarua, n.d.). This gives guidance on how to use learners' LNAAT results in identifying the starting point for reading development in Pathways Awarua and accomplish learning as an interactive event.

The main aim of this article is to report on the impact of Pathways Awarua on the reading performance of Step-1 and Step-2 WTA learners for three periods. Period 1 covered 2017 to 2019 (pre-COVID-19) (P1); Period 2, 2020 and 2021 (hybrid COVID-19 online support and out-of-lockdown support for the period); and Period 3, 2022 and 2023 (post-COVID-19 Pathways Awarua support).

The literature study refers in brief to the main findings and recommendations of the Ministry of Education's (2023) annual report, the value of computer-adaptive assessment tools such as the LNAAT to arrive at individualised

descriptions of learners' current reading needs, and the dynamic assessment interface between the LNAAT and Pathways Awarua modules where both have been aligned with the reading progressions (TEC, 2008a, b).

Our research questions relate to the reading performance calculated for the three levels of the Group variable (P1, P2 and P3) as well as two ethnicities (Priority [Māori and Pasifika] and Pākehā learners). Our research methods were quantitative, including descriptive statistics (means and standard deviations), analysis of variance for initial and progress scores, as well as repeated measures analysis to compare initial (Time-1) and progress (Time-2) scores. We used standard hypothesis testing to compare means for the levels of the two independent variables, *Group* and *Ethnicities*. Our findings, discussion, as well as conclusions and recommendations follow. At this juncture, it is noted too that this study received ethics approval from the Wintec Human Ethics Research Group on 10 April 2024 against reference number WTLR07090424.

LITERATURE STUDY

Outline

The findings and recommendations of the Ministry of Education's annual report for 2023 (MoE, 2023) provide the context for this study and serve as backdrop for a comparison of the reading performance of Step-1 and Step-2 learners for three periods: pre-COVID-19 (2017 to 2019) (P1), COVID-19 (2020 and 2021) (P2), and post-COVID-19 (P3). The 2020 and 2021 (P2) cohorts were exposed to online support during the lockdowns, as well as regular LN-embedding practices by tutors and tailored support from learning advisors outside the lockdowns, while the 2022 and 2023 (P3) cohorts were subject to LN-embedding practices by tutors and the systematic introduction of Pathways Awarua modules by WTA advisors as an intervention. A brief account is given of the LNAAT as a computer-adaptive reading assessment tool which yields protocols describing individual learner needs at their current level of competence.

The last topic highlights the dynamic interface between identifying individual reading needs and then selecting modules from Pathways Awarua that target those needs. The LNAAT and Pathways Awarua are aligned with the reading progressions (TEC, 2008a, b). This ensures a dynamic assessment framework integrating initial diagnostic assessments of learner needs, modules directed at these needs, and progress assessments.

The state of literacy and numeracy development in New Zealand

The New Zealand Ministry of Education's annual report (2023) cites the internationally acclaimed PISA (Programme for International Student Assessment) (2018) results (among other sources) which indicate declines in the reading performance of 15-year-old learners in the country. Later in the year, May and Medina (2023) reported similar results from PISA 2022. Notably, the Ministry of Education 2023 annual report refers to the "scarring" effects of the COVID-19 lockdowns on learning, citing all-time low pupil attendance, barriers to school attendance, staff shortages, and low availability of relief staff as some of the negative factors during and immediately after the lengthy COVID-19 lockdowns. The report also refers to "several decades of stagnation in literacy and numeracy, as measured domestically" (MoE, 2023, p. 6).

The Ministry of Education's summary of the PISA 2022 results (May & Medina, 2023) published in December 2023, after the Ministry's annual report, highlights a 28-point (or 2.8 percent) decline in reading performance from 2000 to 2022. This decline was not deemed statistically significant. The report did note that the proportion of 15-year-olds below the baseline of reading proficiency increased by seven percent from 2000 to 21 percent in 2022. Also, 79 percent of the NZ group remained above these levels, which was five percent above the OECD performance.

These findings suggested that WTA learners in the at-risk category (Step 1 and Step 2 on the reading progressions), who were already targeted in LN-embedded and learner support strategies at the institute, could and should be tracked to note any adverse COVID-19 impacts on reading skills.

To argue the case, pre-COVID-19 reading data were included in the data base. Paired samples of learners' reading scores obtained within each of the three periods were collated in a data set. Other ethnicities were not that well represented and were omitted. Likewise, Pasifika learners' numbers were low which meant that their data were collated with those of Māori learners under *Priority learners.* This meant that the independent variable, *Ethnicities,* had two levels (*Priority* and *Pākehā learners*). The second independent variable was *Group* with three levels (pre-COVID-19, P1; COVID-19, P2; and post-COVID-19, P3). The dependent variables were *Time-1 scores (Initial assessments)* and *Time-2 scores (Progress assessments).*

The Ministry of Education's 2023 annual report places front of mind not only the so-called stagnation in LN levels, but also the expressed teacher need for professional development, curriculum refresh actions, and closer engagement with educators. Feedback from WTA learning advisors articulated the same need: how were they to mediate the learning process as it unfolded in an interactive online environment such as Pathways Awarua?

The findings reported in this article remain positive: consistently, for the three years prior to the COVID-19 lockdowns (P1), the COVID-19 period (P2), and the post-COVID-19 period (P3), we found remarkably similar baseline values on initial and progress assessment scores for these learners. For the seven years under review, comparisons of within-subjects means yielded statistically significant differences, with a large effect size (partial eta squared value) for the group (N=304). For similar comparisons of reading performance at the institute (partial eta squared values >0.14), see the most recent institutional report (Greyling et al., 2024).

Instead of arguing for "stagnation" and "decline," a case is made for "plateauing" in reading performance. The present is a key moment in "breaking through resistance levels" based on pre-COVID-19, COVID-19 and post-COVID-19 reading performance. Arguably, the current LN approach at the institute may have passed the COVID-19 stress test (Dohaney et al., 2020), countering significant declines in reading performance for the target population of at-risk students.

The Literacy and Numeracy for Adults Assessment Tool (LNAAT) as a computer-adaptive tool

The LNAAT, aligned in its design with the reading and numeracy progressions (TEC, 2008a, b, c), is an interactive online tool with functionality consistent with the principles of computer-adaptive assessment (Van der Linden & Glas, 2000; Veldkamp & Sluijter, 2019; Veldkamp & Verschoor, 2019). This means that a learner's current response, either correct or incorrect, will prompt the next-item-selection algorithm randomly to pick an item based on that response. If the response is correct, the next-item-selection algorithm will pick a more difficult item; if incorrect, a less difficult item. This continues until the upper boundary of learner performance can be determined, at which point the termination algorithm will be activated, and a result generated.

It is important to note that the Tertiary Education Commission (TEC) appointed the New Zealand Centre for Educational Research (NZCER) as custodian of the LNAAT. Psychometricians and analysts at NZCER regularly calibrate the items in the item bank, tracking and advising TEC on item performance. These tool-integrity checks include aspects typically associated with Item Response Theory (IRT) such as parameter estimates for items in the item bank (Baker & Kim, 2004), item analyses following the RASCH model, differential item functioning, and construct validity (Baker & Kim, 2004; B. Gardiner, E. Lawes, & J. Mazengarb, personal communication, May 5, 2022; Jalali, 2009; Kamata & Vaughn, 2004; Martinková et al., 2017).

Alignment between the LNAAT and Pathways Awarua

Pathways Awarua, under the custodianship of Ako Aotearoa, offers reading development modules which, like the LNAAT, are aligned with the Steps in the reading progressions (TEC, 2008a, b). Individual learners or their tutors may access the resource and tailor the choice of module to the diagnostic information in individual LNAAT protocols. Once learners have worked through the so-selected modules and have attended their programme, they sit the LNAAT progress assessment (TEC, 2023).

An example of such a dynamic assessment framework is reported in Navarro and Mourgues-Codern (2018) who conducted a study aimed at enhancing Spanish-speaking elementary students' learning. Employing computer-adaptive testing as a diagnostic to identify an individualised starting point for each learner, they applied a scaffolding approach derived from graduated prompts to progress learner competence beyond current knowledge and skill. This approach, consistent with Vygotskyan theory, emphasises the critical role of teacher intervention in facilitating student learning beyond their current skill levels (Derry, 2013; Tudge, 1990; Verschoor & Straetmans, 2000; Vygotsky, 1978).

Broadly speaking, literacy and numeracy practices at the institute have followed a dynamic assessment framework for more than a decade (TEC, 2009). A similar pattern was identified for the three targeted groups: at Time 1 (initial assessment), the LNAAT results yielded individualised diagnostic information to plan interventions; for the pre-COVID-19 (P1) and the COVID-19 group (P2), LN-embedding practices and tailored, incidental LN support from WTA learning advisors were on offer, either in person or online; for the intervention group (P3), Pathways Awarua was introduced alongside LN-embedding practices; and at Time 2 (Progress assessments), the LNAAT was used to track reading gains at the end of each period.

RESEARCH QUESTIONS AND QUANTITATIVE METHODS

The following research questions were posed:

- Would LNAAT reading scores differ significantly for the pre-COVID-19, COVID-19 and post-COVID-19 groups?
- How would the performance of two ethnicities (Priority [Māori and Pasifika] and Pākehā) compare within and between groups?

The following hypotheses were tested:

For between-group comparisons:

- *Hypothesis 1*: The differences in scale score means for the independent variables (Group and Ethnicities) at Time 1 were not statistically significant.
- *Hypothesis 2*: The differences in scale score means for the independent variables (Group and Ethnicities) at Time 2 were not statistically significant.

For within-group comparisons:

- *Hypothesis 3:* The differences in scale score means between Time 1 and Time 2 were not statistically significant.
- *Hypothesis 4:* There was no interaction effect between Time and the two independent variables (Group and Ethnicities).

Hypothesis 1 was included to establish whether significant group and ethnicity-specific differences in reading performance existed at Time 1 (Initial Assessment)—a comparison of Time-1 and Time-2 means for groups at different baselines would pose a validity challenge. Put differently, we could only proceed with the comparison if the Time-1 means for the independent variables (Groups and Ethnicities) were at the same baseline values.

Hypothesis 2 was intended to identify whether statistically significant group and ethnicity-specific differences obtained between the levels of the two independent variables, Group and Ethnicities, at Time 2 (Progress Assessment). If they started from the same baseline (hypothesis 1), we could then determine whether statistically significant between-group differences obtained at this point.

Hypothesis 3 was aimed at a repeated measures analysis for the full cohort to see whether the full cohort had achieved statistically significant gain in a within-subject comparison of means.

Hypothesis 4 was intended to identify any interaction effects between the Time-1 and Time-2 comparisons and the levels of the independent variables, Group and Ethnicities. Descriptive statistics (means and standard deviations), analysis of variance (ANOVA) and repeated measures ANOVA were applied to address the four hypotheses.

As stated earlier, paired samples of reading scores for each of the three periods were collated for two independent variables: Ethnicities (Priority and Pākehā learners) and Group (P1, P2 and P3). Reading scale scores at Time 1 and Time 2 were the dependent variables and allowed for repeated measures analysis.

The institute has consistently pursued one hundred percent learner participation rates in LNAAT for all years. The data selection was not random, but included all reading scores for learners whose scores could be paired within each of the three periods. Sample sizes are cited in Figure 1.

FINDINGS

This section deals with descriptive statistics for the two independent variables, as well as ANOVA results for between-subject and within-subject comparisons. Figure 1 shows the means and standard deviations for the Pre-COVID-19 (P1), the COVID-19 (P2) (2020 and 2021) and the Post-COVID-19 groups (P3) (2022 and 2023):

Repeated	Group/Period	Learners	Mean /1000	Std. Deviation	N
Time-1 reading scores	P1	Priority	477.9	44.3	73
		Pākehā	469.5	48.0	46
		Total	474.6	45.7	119
	P2	Priority	477.7	39.8	54
		Pākehā	486.1	38.0	30
		Total	480.7	39.2	84
	P3	Priority	481.9	36.4	45
		Pākehā	483.2	45.0	56
		Total	482.6	41.2	101
	Total (Time 1)	Priority	478.9	40.7	172
		Pākehā	479.1	44.9	132
		Total	479.0	42.5	304
Time-2 reading scores	P1	Priority	543.0	70.2	73
		Pākehā	563.6	60.8	46
		Total	551.0	67.2	119
	P2	Priority	530.0	57.5	54
		Pākehā	538.3	68.4	30
		Total	533.0	61.4	84
	P2	Priority	544.9	53.1	45
		Pākehā	546.1	76.9	56
		Total	545.6	67.0	101
	Total (Time 2)	Priority	539.4	62.2	172
		Pākehā	550.4	69.9	132
		Total	544.2	65.8	304

Abbreviations:

P1 = Pre-COVID-19 Tailored Support & LN-embedding practices;
P2 = COVID-19 lockdowns (online support) & post-lockdown face-to-face support; as well as
P3 = Post-COVID-19 Pathways Awarua & LN-embedding practices.

Figure 1: Means and standard deviations by Group and Ethnicity for Time-1 and Time-2 reading performance.

The similarity in reading performance at Time 1 and Time 2 is clear from a visual scan of Figure 2 below. The Time-1 and Time-2 means varied by a small margin. An eyeball-scan shows that these differences within the three groups of Priority learners were at 1 percent at Time 1 and 1.5 percent at Time 2. For the three groups of Pākehā learners, these differences were at 1.5 percent at Time 1 and 2.5 percent at Time 2 for the three periods.

A between-group comparative scan of Priority and Pākehā learners' scores revealed a difference of less than 1 percent at Time 1 and 3.4 percent at Time 2. These differences are clear from Figure 2 and can be cross validated against the data in Figure 1.

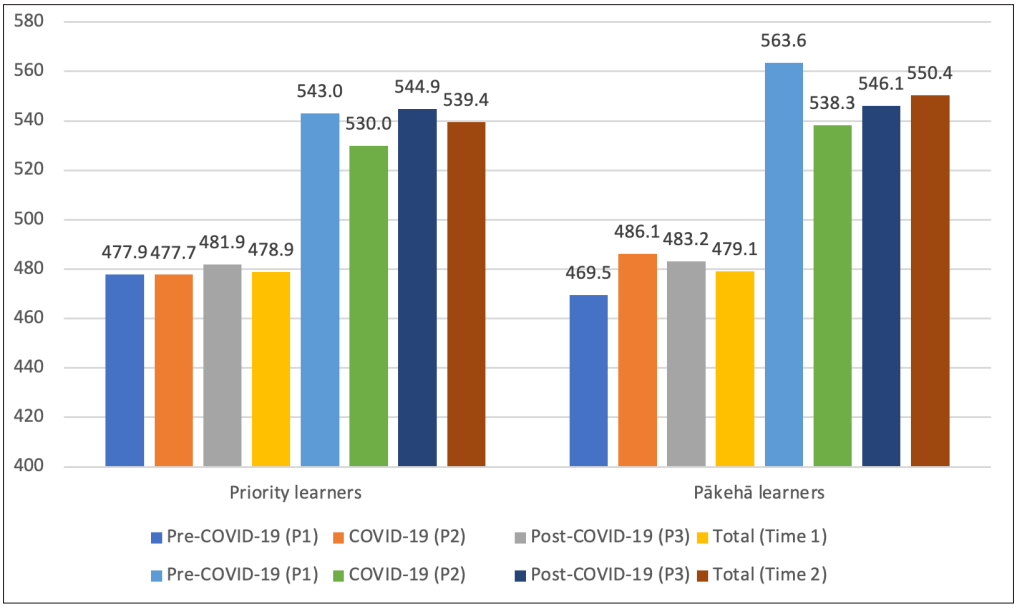

Figure 2: Means by Group and Ethnicity for Time-1 and Time-2 reading performance.

It would seem from these results that the COVID-19 lockdowns may not have had a significantly negative effect on reading scores. To explore this tentative conclusion, one-way between-subject ANOVAs were computed for the levels of Group and Ethnicities.

Between-subject comparisons for the levels of Group and Ethnicities

Neither hypothesis 1 nor hypothesis 2 could be rejected: No statistically significant differences were found for either Group or Ethnicities when Time-1 and Time-2 scores were analysed separately. At Time 1 the subjects in the three levels of group started from a similar baseline. These appear in the blocked text below:

Hypothesis 1	The differences in scale score means for the independent variables (Group and Ethnicities) at Time 1 were not statistically significant.
Statistical analysis	One-way ANOVA analyses of Time-1 means.
Findings	For Group comparison (3 levels): $F[2/301]=1.065$, $p<0.346$ For Ethnicity comparison (2 levels): $F[1/302]= 0.002$, $p<0.966$
Conclusion	No statistically significant differences in means at Time 1 were found for the two levels of each independent variable. For both independent variables, the subjects started from a similar baseline performance which enhanced the validity of the comparison.

Figure 1 and Figure 2 confirm remarkably similar starting points for the levels of the two independent variables: Group (P1, P2 and P3); and Ethnicities (Priority [Māori and Pasifika]; and Pākehā learners). Likewise, the ANOVA results for Time 2 did not yield any statistically significant differences and are cited in the blocked text below:

Hypothesis 2	The differences in scale score means for the independent variables (Group and Ethnicities) at Time 2 were not statistically significant.
Statistical analysis	One-way ANOVA analyses of Time 2 means.
Findings	For Group comparison (3 levels): $F[2/301]=1.892$, $p<0.152$ For Ethnicity comparison (2 levels): $F[1/302]=2.103$, $p<0.148$
Conclusion	No statistically significant differences in means at Time 2 were found for the two levels of each independent variable. For both independent variables, the subjects recorded progress scores that were at similar levels which meant that if they improved, differences in Time-2 means were negligibly small.

Within-group comparisons for variables Group and Ethnicities

Hypotheses 3 and 4 were investigated and the following results recorded: Hypothesis 3 could be rejected because a statistically significant difference was found when Time 1 (Initial Scale Score means) and Time 2 (Progress Scale Score means) were compared. This was clear from the repeated measures ANOVA results for within-subjects comparisons—the Wilks' Lambda value in the multivariate tests output yielded the following result: $F(1, 298)=322.312$, $p<0.000$, $\eta^2=0.52$. This statistically significant result also has practical significance, given that the η^2 (partial eta squared value) of 0.52 is far above the 0.14 cut-off value for a large statistical effect.

We rejected the null hypothesis that there was not a statistically significant difference in the within-subjects means comparison of Time-1 and Time-2 comparison computed for all learners (N=304). The results for hypothesis 3 are captured below:

Hypothesis 3	The differences in scale score means between Time 1 and Time 2 were not statistically significant.
Statistical analysis	Repeated measures ANOVA analysis of within-subjects comparison for the collective of subjects.
Findings	Time 1 vs Time 2 comparison: $F[1/298]=322.212$, p,0.000*, $\eta_p=0.52$
Conclusion	We rejected the null hypothesis. The probability value of less than 0.1 percent and the partial eta squared value (η_p) showed that the magnitude of the difference in scores was practically significant given the value of 0.52 (which was significantly above the threshold of 0.14).

Hypothesis 4 focused on interactions: For the interaction effects, we found none for Time and Ethnicity; however, a small effect was noted for Time and Group. The magnitude of this difference was a partial eta squared value of 0.032 which is deemed small (Field, 2017). This meant that neither Group nor Ethnicities impacted on the variance in the magnitude of the difference between Time-1 and Time-2 scores. This is consistent with the earlier finding that no significant differences were present in between-subject and between-group comparisons (hypothesis 2). For consistency, these results are cited below:

Hypothesis 4	There was no interaction effect between Time and the two independent variables (Group and Ethnicities).
Statistical analysis	Interaction effects in the repeated measures ANOVA analyses.
Findings	For Time*Ethnicity effect: $F[1/302]=1.763$, $p<0.185$ For Time*Group effect: $F[2/301]=4.934$, $p<0.008$*, $\eta_p=0.032$
Conclusion	No interaction effect was found in the repeated measures ANOVA between Time and the Ethnicity variable; however, a statistically significant effect was recorded for Time and Group—the partial eta value of 0.032 indicated a small effect with no practical significance (Field, 2017). The magnitude of these differences was negligible as no statistically significant differences in the follow-up pairwise comparison of the three groups' progress were found.

DISCUSSION

These results indicate that no significant between-group differences obtained when either the Group or Ethnicities variables were compared. The results for the first independent variable, Group, indicate that no differences in performance were found at either Time 1 (Initial Assessment) or Time 2 (Progress Assessment). The implication is that the three cohorts (P1, P2 and P3) started from the same baseline which means that they were relatively similar in terms of their initial reading skills. In addition, the implication is that the literacy support offered by the WTA advisors to the pre-COVID-19 (2017–2019, P1), the COVID-19 (2020 and 2021, P2) and the post-COVID-19 groups (2022 and 2023, P3) yielded similar results.

As an intervention, the effect of Pathways Awarua was not significantly different compared to the tailored, incidental support of the preceding five years (2017–2021). How learners were supported might have had an inhibiting effect: it was noted that the advisors supervised learner access to Pathways Awarua but did not systematically mediate learning on this interactive online resource. Mediation and instructional support, it was argued, could assist targeted learners to break through the "resistance level" noted earlier.

The repeated measures analysis showed that statistically significant gains had been achieved by the three groups. The significant effect size when means were compared for the full group indicates that educator and advisor LN support on offer to learners on the programme has been successful irrespective of mode of support. An effect size of 0.52 is large and significantly above the value of 0.14 mentioned in the literature for large effects (Field, 2017). No practically significant interaction effects were found for Ethnicity or Group.

Post-COVID-19 performance should be viewed in the light of the statistically significant gains achieved. This not only applies to the Group variable (P1, P2 and P3), but also to the two ethnicities in question. From an equity point of view, no statistically significant differences were found for the interaction between the reading measures (Time) and the Ethnicity variable. Figure 1 and Figure 2 show how remarkably close the means were for the two ethnicities we investigated in the separate between-groups Time-1 and Time-2 comparisons.

Our contention is that Pathways Awarua should remain the LN-development resource of choice. To break through the resistance levels we have found, educators need to be trained in systematically using appropriate interactional strategies and graduated prompts to lift learner engagement when they work on Pathways Awarua modules.

CONCLUSION AND RECOMMENDATIONS

The following conclusions were arrived at:

- For the three groups of learners (Pre-COVID-19, COVID-19 and Post-COVID-19) statistically significant gains were recorded. The high partial eta squared value of 0.52, alongside the significant probability value ($p<0.000$), meant that practically significant progress had been achieved.
- The modes of delivery associated with each group (or period) yielded similar results. At worst, one may argue that the similar means at Time 2 for the seven-year period indicate a plateauing in performance which represents a resistance level to be breached rather than stagnation.
- It is argued that this resistance level can be breached if educators and advisors are trained to mediate learners' online learning experience of Pathways Awarua modules. Mediated learning would include using prompts, asking questions, giving clues and engaging in extended sequences of interaction, as well as activating implicit, explicit and fading prompts.
- The LN-embedding practices of trained vocational educators were a constant across the seven-year period and these positive effects should be neither underestimated nor neglected.

We recommend that:

- the WTA support team and vocational educators be trained in instructional strategies to align the choice of Pathways Awarua modules and the individualised needs of learners; as well as to develop and implement appropriate instructional mediation strategies to support targeted learners.
- appropriately trained vocational educators be taken through a renew and refresh project to be reminded of LN-embedding processes and how the LNAAT and Pathways Awarua can be optimally integrated into a dynamic assessment framework.
- educators and advisors alike be strongly encouraged to participate in Ako Aotearoa training on the use of LNAAT and Pathways Awarua.
- this study be replicated once the recommendations above have been implemented.

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Willfred Greyling has worked in applied linguistics and literacy development for approximately 30 years. He takes a keen interest in interdisciplinary studies from a personal construct psychology perspective. More recently, he has focused on embedded literacy and numeracy in L1 to L4 vocational tertiary training in New Zealand.
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